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PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Richard R. Hertzog et al

Appln. No. (Cont. of 08/601,879)

Group Art Unit:

Filed: Concurrently Herewith

Examiner:

For: Decomposition of Cumene Hydroperoxide

**PRELIMINARY AMENDMENT
AND NOTIFICATION OF INTERFERENCE WITH REISSUE NO. 08/545,092**

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Please amend the above-identified application as follows.

IN THE CLAIMS

Cancel claims 1-6, without prejudice, substituting in lieu thereof, the following new slate of claims 7-43:

--7. An improved method for the decomposition of cumene hydroperoxide by acidic catalyst to phenol and acetone wherein the improvement comprises decomposing cumene hydroperoxide in a continuous manner in a decomposition reactor using sulfuric acid as the acidic catalyst in the presence of cumene and excess acetone whereby the reactor composition includes 10 to 100 percent excess acetone relative to the amount of acetone produced during the reaction whereby the rate of decomposition of cumene hydroperoxide is reduced and the reaction is more controllable and more selective.

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8. The method in accordance with claim 1, wherein cumene hydroperoxide is decomposed in a non-isothermal manner.

9. The method in accordance with claim 8, wherein a cumene oxidation product feed stream and an acetone solution recycle stream are pumped into said decomposition reactor, wherein said cumene oxidation product contains 81.6 wt% cumene hydroperoxide (CHP), 5.00 wt% dimethylphenyl carbinol (DMPC) and 0.40 wt% acetophenone, the balance being mostly cumene; wherein said acetone solution contains 0.86 wt% alpha methyl styrene (AMS), 2.06 wt% phenol, 5.83 wt% cumene, 1.60 wt% water and 0.0512 wt% sulfuric acid; wherein said cumene oxidation product feed stream is continuously introduced into said decomposition reactor at a rate of 1.62 parts by weight per minute; and wherein said acetone solution recycle stream is continuously introduced into said decomposition reactor at a rate of 0.230 parts by weight per minute.

10. The method in accordance with claim 8, wherein the molar ratio of acetone to phenol in the reactor composition is about 1.4:1.

11. An improved method for the decomposition of cumene hydroperoxide by acidic catalyst to phenol and acetone wherein the improvement comprises decomposing cumene hydroperoxide in a continuous manner using sulfuric acid as the acidic catalyst in the presence of excess acetone, wherein the acetone is thoroughly mixed with cumene hydroperoxide feedstream and the reactor composition includes 10 to 100 percent excess acetone relative to the amount of acetone produced during the reaction whereby the rate of decomposition of cumene hydroperoxide is reduced and the reaction is more controllable and more selective.

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12. The method in accordance with claim 11, wherein cumene hydroperoxide is decomposed in a non-isothermal manner.

13. The method in accordance with claim 12, wherein the molar ratio of acetone to phenol in the reactor composition is about 1.4:1.

14. An improved method for the decomposition of cumene hydroperoxide by acidic catalyst to phenol and acetone wherein the improvement comprises decomposing cumene hydroperoxide in the presence excess acetone, whereby the reactor composition includes 10 to 100 percent excess acetone relative to the amount of acetone produced during the reaction whereby the rate of decomposition of cumene hydroperoxide is reduced and the reaction is more controllable and more selective.

15. The method in accordance with claim 14, wherein cumene hydroperoxide is decomposed in a non-isothermal manner.

16. The method in accordance with claim 15, wherein the molar ratio of acetone to phenol in the reactor composition is about 1.4:1.

17. An improved method for the decomposition of cumene hydroperoxide by acidic catalyst to phenol and acetone wherein the improvement comprises decomposing cumene hydroperoxide in the presence of excess acetone in a multiplicity of separate sequential reactors each with a controlled temperature range, whereby the reactor composition includes 10 to 100 percent excess acetone relative to the amount of acetone produced during the reaction whereby the rate of decomposition of cumene hydroperoxide is reduced and the reaction is more controllable and more selective.

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18. A method according to claim 17, wherein said cumene hydroperoxide is decomposed in a non-isothermal manner.

19. The method in accordance with claim 18, wherein the molar ratio of acetone to phenol in the reactor composition is about 1.4:1.

20. The method in accordance with claim 19, wherein a first reactor is operated in a temperature range of about 50°C to about 90°C.

21. The method in accordance with claim 19, wherein the outlet stream of a decomposition reactor is passed into a reactor of plug flow design and smaller size compared to the decomposition reactor wherein the outlet temperature of the plug flow reactor is higher than the inlet temperature of the plug flow reactor.

22. The method in accordance with claim 19, wherein the acidic catalyst is sulfuric acid.

23. The method in accordance with claim 11 wherein the catalyst is in a concentration of from about 30 to 500 ppm of the weight of the reaction mass.

24. The method in accordance with claim 1 wherein the temperature of the cumene hydroperoxide decomposition is about 50 to 90 °C.

25. An improved method for the decomposition of cumene hydroperoxide by acidic catalyst to phenol and acetone wherein the improvement comprises decomposing cumene hydroperoxide in a continuous non-isothermal manner using sulfuric acid as the acidic catalyst in the presence of excess acetone whereby the acetone is thoroughly mixed with cumene hydroperoxide feedstream and the reactor composition includes 10 to 100 percent excess acetone relative to the amount of acetone produced during the reaction wherein the quantity of cumene

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hydroperoxide remaining after decomposition is from 0.2 to 3 wt. % of the total weight of the decomposition products whereby the rate of decomposition of cumene hydroperoxide is reduced and the reaction is more controllable and more selective.

26. An improved method for the decomposition of dicumyl peroxide to alpha methyl styrene, phenol and acetone, in the presence of an acidic catalyst wherein the improvement comprises:

(a) carrying out a decomposition of cumene hydroperoxide in the presence of an acidic catalyst and excess acetone to produce phenol, acetone, and dicumyl peroxide,

(b) in a separate vessel, heating the dicumyl peroxide from step (a) to a temperature of greater than 90° C and carrying out the decomposition of dicumyl peroxide in the presence of an acidic catalyst whereby selectivity for alpha methyl styrene is enhanced;

(c) feeding at least a portion of the decomposition products of (b) to a separate vessel wherein acetone is allowed to evaporate; and

(d) recycling at least a portion of the acetone collected from step (c) to the cumene hydroperoxide decomposition of step (a).

27. A composition comprising cumene hydroperoxide, cumene, acidic catalyst for decomposition of cumene hydroperoxide, dicumyl peroxide, dimethylbenzyl alcohol, phenol, and acetone wherein the acetone is in a molar ratio to phenol in excess of 1.

28. The composition in accordance with claim 27, wherein the molar ratio of acetone to phenol in the composition is about 1.4:1.

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29. An improved method for preparing phenol and acetone from the decomposition of cumene hydroperoxide with an acidic catalyst wherein the improvement comprises (a) decomposing cumene hydroperoxide in the presence of cumene and at a specific catalyst concentration and temperature whereby a composition comprising phenol, acetone and dicumyl peroxide is formed, (b) transferring dicumyl peroxide to a plug flow reactor wherein decomposition of dicumyl peroxide to phenol, acetone and alphas-methylstyrene occurs at a higher temperature than the temperature in step (a) whereby the dicumyl peroxide decomposition is better controlled.

30. The method in accordance with claim 29, wherein a cumene oxidation product feed stream and an acetone solution recycle stream are pumped into the decomposition reactor of step (a), wherein said cumene oxidation product contains 81.6 wt% cumene hydroperoxide (CHP), 5.00 wt% dimethylphenyl carbinol (DMPC) and 0.40 wt% acetophenone, the balance being mostly cumene; wherein said acetone solution contains 0.86 wt% alpha methyl styrene (AMS), 2.06 wt% phenol, 5.83 wt% cumene, 1.60 wt% water and 0.0512 wt% sulfuric acid; wherein said cumene oxidation product feed stream is continuously introduced into said decomposition reactor of step (a) at a rate of 1.62 parts by weight per minute; and wherein said acetone solution recycle stream is continuously introduced into said decomposition reactor of step (a) at a rate of 0.230 parts by weight per minute.

31. An improved method for preparing phenol and acetone from the decomposition of cumene hydroperoxide with an acidic catalyst wherein the improvement comprises:

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(a) decomposing cumene hydroperoxide at a specific acidic catalyst concentration and temperature whereby a composition comprising phenol, acetone and dicumyl peroxide is formed,

(b) transferring dicumyl peroxide to a plug flow reactor wherein decomposition of dicumyl peroxide to phenol, acetone and alphas-methylstyrene occurs at higher temperature than the temperature in step (a) whereby the dicumyl peroxide decomposition is better controlled, wherein step (a) the temperature is from about 50°-90° C. and the catalyst concentration is from about 30-500 ppm of the decomposition mass and in step (b) the temperature is from about 90° to 150° C.

32. An improved method for maintaining control of an acid catalyzed cumene hydroperoxide decomposition in a multiplicity of sequential reactors wherein the improvement comprises passing a portion of the outlet stream of a back mixed reactor into a reactor of plug flow design and a smaller size compared to the cumene hydroperoxide decomposition reactors wherein the inlet temperature is lower than the outlet temperature of said plug flow reactor whereby the smaller size reactor decomposes essentially all of the cumene hydroperoxide remaining in said portion of the outlet stream and provides an analytical indication of the completeness of the cumene hydroperoxide decomposition reaction and the reactors are thereby controlled.

33. An improved method for enhancing the decomposition of cumene hydroperoxide and producing cumene hydroperoxide decomposition products therefrom wherein the improvement comprises recycling the cumene hydroperoxide decomposition products to a cumene

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hydroperoxide feedstream and wherein additional acetone is added to the cumene hydroperoxide decomposition products so as to add 10 to 100 percent acetone relative to the amount of acetone produced during the cumene hydroperoxide decomposition reaction whereby selectivity is higher and safety of the process is improved.

34. The method in accordance with claim 33 wherein additional water is added to the cumene hydroperoxide decomposition products to a level not greater than 4 wt. % in the cumene hydroperoxide decomposition mass.

35. The method in accordance with claim 34 wherein the level is between 0.03 and 1.34 wt %.

36. An improved method for the decomposition of cumene hydroperoxide to phenol and acetone wherein the improvement comprises decomposing cumene hydroperoxide in a decomposition reactor in the presence of cumene and introducing additional water into the cumene hydroperoxide decomposition reactor.

37. A method according to claim 36, wherein said cumene hydroperoxide is decomposed in a non-isothermal manner.

38. The method in accordance with claim 37, wherein a cumene oxidation product feed stream and an acetone solution recycle stream are pumped into the decomposition reactor of step (a), wherein said cumene oxidation product contains 81.6 wt% cumene hydroperoxide (CHP), 5.00 wt% dimethylphenyl carbinol (DMPC) and 0.40 wt% acetophenone, the balance being mostly cumene; wherein said acetone solution contains 0.86 wt% alpha methyl styrene (AMS), 2.06 wt% phenol, 5.83 wt% cumene, 1.60 wt% water and 0.0512 wt% sulfuric acid; wherein said

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cumene oxidation product feed stream is continuously introduced into said decomposition reactor of step (a) at a rate of 1.62 parts by weight per minute; and wherein said acetone solution recycle stream is continuously introduced into said decomposition reactor of step (a) at a rate of 0.230 parts by weight per minute.

39. A cumene hydroperoxide decomposition mass produced from the reaction of cumene hydroperoxide with an acid catalyst, wherein the acid catalyst is sulfuric acid, in a continuous manner having 10 to 100 percent excess acetone relative to the amount of acetone produced during the reaction and cumene.

40. A method according to claim 39, wherein said cumene hydroperoxide is decomposed in a non-isothermal manner.

41. The composition in accordance with claim 40, wherein the molar ratio of acetone to phenol in the reactor composition is about 1.4:1.

42. The method in accordance with claim 41, wherein a cumene oxidation product feed stream and an acetone solution recycle stream are pumped into a decomposition reactor, wherein said cumene oxidation product contains 81.6 wt% cumene hydroperoxide (CHP), 5.00 wt% dimethylphenyl carbinol (DMPC) and 0.40 wt% acetophenone, the balance being mostly cumene; wherein said acetone solution contains 0.86 wt% alpha methyl styrene (AMS), 2.06 wt% phenol, 5.83 wt% cumene, 1.60 wt% water and 0.0512 wt% sulfuric acid; wherein said cumene oxidation product feed stream is continuously introduced into said decomposition reactor at a rate of 1.62 parts by weight per minute; and wherein said acetone solution recycle

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stream is continuously introduced into said decomposition reactor at a rate of 0.230 parts by weight per minute.

43. A method for the efficient generation of recycle acetone from cumene in a process which prepares phenol from cumene comprising:

(a) decomposing dicumylperoxide to phenol, acetone, and alpha methyl styrene

(b) feeding at least a portion of decomposition products of (a) to a separate vessel wherein operating temperature is higher operating pressure is lower than in step (a), thereby allowing acetone to evaporate,

(c) sending at least a portion of acetone collected from step (b) to the cumene hydroperoxide decomposition reaction.--

REMARKS

Original claims have been replaced by new claims 7-43. These new claims 7-43 (hereinafter referred to as the "Hertzog" claims) substantially copy claims pending in the merged reexamination and reissue of the Zakoshansky U.S. Patent No. 5,254,751. These claims of the Zakoshansky reexamination/reissue are referred to hereinafter as the "Zakoshansky" claims.

Support in the present application for Hertzog claims 7-43 is discussed hereinafter with particular reference to a Claim Chart provided on pages 35-82 of this Preliminary Amendment. The first two columns of this Claim Chart provides a side-by-side comparison of elements of Zakoshansky claims with elements of Hertzog claims. In a third column, styled COMMENTS,

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in this Claim Chart, support is demonstrated in the present Hertzog specification for each of the elements of the Hertzog claims. This COMMENTS column also provides some explanation as to why the Hertzog claims define the same patentable invention as the Zakoshansky claims. Further explanation, as to why the Hertzog claims define the same patentable invention as the Zakoshansky claims, is provided in a narrative form below.

REISSUANCE OF ZAKOSHANSKY'S PATENT IS BLOCKED BY HERTZOG'S APPLICATION

As pointed out in MPEP 2303, when the claims to the same patentable invention of one applicant are more than six (6) months senior to the corresponding claims of another applicant, an interference should not be declared. When such claims to the same patentable invention are made, MPEP 706.02(f) dictates that the senior application should be issued and the junior application should be rejected over the patent of the senior applicant:

If the filing dates of the applications are within 6 months of each other (3 months for simple subject matter) then interference may be proper. *See* MPEP Chapter 2300. Otherwise, the application with the earliest effective filing date must be allowed to issue. After the allowed application is published, it can be used as a reference in a rejection under 35 U.S.C. 102(e) in the still pending application.

MPEP 706.02(f).

Actually, the mandate of MPEP 706.02(f), to issue the senior application, extends beyond situations where the senior and junior applications are claiming the same patentable subject matter. As long as the disclosure of the senior application would be a reference under 35 U.S.C. 102(e) and claims allowable subject matter, the senior application should be issued as a patent and applied as a

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reference against the junior application. It is clear that the disclosure of the present application would anticipate a number of Zakoshansky claims.

The disclosure of the present Hertzog application is identical to the disclosure of all of its predecessor applications, including Serial No. 07/297,333, filed January 17, 1989. Therefore, Hertzog's claims are entitled to an effective filing date of January 17, 1989. The earliest effective filing date for the reissue application of Zakoshansky is the September 14, 1992 filing date of Serial No. 07/944,688.

The Hertzog application is nearly 19 months senior to the Zakoshansky reissue application. Therefore, Hertzog's application should issue as a patent, and Zakoshansky's claims should be rejected over Hertzog's patent. MPEP 706.02(f), MPEP 2303.

HERTZOG'S CLAIMS ARE SUPPORTED BY THE PRESENT APPLICATION AND ITS PREDECESSOR APPLICATIONS

A detailed explanation of the support for Hertzog's claims 7, 11, 14, 17, 20-27, 29, 31-36, 39 and 43 is provided in the COMMENTS section of the Claim Chart on pages 35-82 of this Preliminary Amendment. A detailed explanation of the support for Hertzog's claims 8-10, 12, 13, 18, 19, 28, 30, 37, 38 and 40-42 is provided in this section below.

Hertzog claims 8, 12, 15, 18, 37 and 40 are dependent claims which recite that cumene hydroperoxide decomposition takes place in a non-isothermal manner. This recitation is supported by the passage of the Hertzog specification extending from page 4, line 24 to page 5, line 7, wherein it is stated that step (a) of the decomposition reaction takes place at 50°C to 90°C (see page 4, line 36) and then the temperature is increased to 120°C to 150°C (see page 5, line 4) in step (b). It is

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further stated in the passage extending from page 7, line 37 to page 8, line 3 that temperature gradients exist in step (a) when a back-mixed reactor is used.

Hertzog claims 9, 30, 38 and 42 are dependent claims which recite particular quantities of compositions, such as cumene and acetone, which are fed and/or recycled into a decomposition reactor. Support for the recitations of Hertzog claims 9, 30, 38 and 42 may be found in Example 1 on page 10, lines 13-28 of the Hertzog specification.

Hertzog claims 10, 13, 16, 19, 28 and 41 are dependent claims which recite that the molar ratio of acetone to phenol in the reactor composition is about 1.4:1. Support for this recitation may be found in Examples 1-4 of the Hertzog specification (see Table 1 on page 12), wherein it is stated that 40 percent of the acetone produced in the decomposition reaction is recycled. As pointed out at column 4, lines 34-37 of the Zakoshansky U.S. Patent No. 5,254,751, acetone and phenol are produced in an essentially 1 to 1 molar ratio in the reaction. If 40 % of the acetone produced is recycled to the decomposition reactor, the molar ratio of acetone to phenol in the reactor would be 1.4 to 1, especially in the final stage of the reactor sequence, wherein maximum conversion to phenol and acetone has taken place.

Even in the early stages of decomposition reactions described in the Hertzog specification, when 40 % of the acetone produce is recycled, the molar ratio of acetone to phenol would be about 1.4:1 in these early stages. At page 7, lines 19-22 of the Hertzog specification, it is stated that the first decomposition reactor may be operated under conditions sufficient to maintain and average cumene hydroperoxide (CHP) concentration of 0.2 to 3 wt%. Since CHP is generally introduced to the reactor in the form of technical grade cumene hydroperoxide,

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having a CHP concentration of about 80 wt%, at any fixed point in time, most of the CHP which had been introduced to the first decomposition reactor has already been decomposed to acetone and phenol.

**HERTZOG'S CLAIMS RECITE THE SAME PATENTABLE SUBJECT MATTER AS
ZAKOSHANSKY'S CLAIMS**

Different claims do not need to set forth identical recitations in order to claim the same patentable invention. Rule 601(n) provides the standard for determining whether the same patentable invention is claimed:

Invention "A" is the same patentable invention as invention "B" when invention "A" is the same as (35 U.S.C. 102) or is obvious (35 U.S.C. 103) in view of invention "B" assuming invention "B" is prior art with respect to invention "A". Invention "A" is a separate patentable invention with respect to invention "B" when invention "A" is new (35 U.S.C. 102) and non-obvious (35 U.S.C. 103) in view of invention "B" assuming invention "B" is prior art with respect to invention "A".

37 CFR 1.601(n).

As demonstrated in the side-by-side comparison in the Claim Chart on pages 35-82 of this Preliminary Amendment, many of the recitations of the Hertzog claims are identical to recitations of Zakoshansky claims.

Insofar as there are differences in the wording between Hertzog's claims and Zakoshansky's claims, these differences do not render Zakoshansky's claims separately patentable from Hertzog's claims.

The differences between the respective claims are discussed below.

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Insofar as Zakoshansky describes a reaction which is “non-isothermal”, so does Hertzog. In order to obviate the difference in wording between Zakoshansky claim 1 and Hertzog claim 7, reaction conditions which are “non-isothermal” are recited in Hertzog claim 8.

A second difference between Zakoshansky claim 1 and Hertzog claim 7 is that Zakoshansky claim 1 recites a particular quantity, i.e. 10 to 18 wt%, of cumene in the reactor. However, this particular quantity of cumene is an immaterial limitation.

As a practical matter, it would be difficult to avoid the presence of from about 10 to 18 weight percent of cumene in the decomposition reactor. Cumene hydroperoxide is typically produced by oxidizing cumene. Residual, unreacted cumene, in an amount of from 10 to 18 weight percent, is typically included in the cumene hydroperoxide. For example, at column 6, line 67 to column 7, line 1 of the Sifniades U.S. Patent No. 4,358,618, there is described a technical cumene hydroperoxide (CHP) containing 83 wt% CHP, 3.2 wt% “carbinol” (a.k.a. dimethylphenyl carbinol, DMPC, dimethylbenzyl alcohol, or DMBA) and 0.4 wt% acetophenone with the balance (i.e. 13.4 wt%) being cumene. Similarly, at column 7, lines 65-67 of the Zakoshansky U.S. Patent No. 5,254,751, there is described a technical cumene hydroperoxide (CHP) containing 83.80 wt% CHP, 3.64 wt% DMBA, 0.40 wt% acetophenone and 12.16 wt% cumene. A similar cumene oxidation product is described at page 10, lines 14-17 of the Hertzog specification and has 81.6 wt% CHP, 5.00 wt% DMPC and 0.40 wt% acetophenone, with the balance (i.e. 13 wt.%) being mostly cumene.

In order to further obviate the differences between Zakoshansky claim 1 and Hertzog claim 7, Hertzog claim 8 has been added herein. Hertzog claim 8 recites the particular quantity

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of cumene introduced into the reactor of Example 1 of the Hertzog specification. This particular quantity of cumene is believed to be encompassed within the range of 10 to 18 wt%, recited in Zakoshansky claim 1.

A third and final difference between Zakoshansky claim 1 and Hertzog claim 7 is that these claims use different wording to express the amount of recycled acetone. However, this difference is not a patentably distinct difference.

As pointed out at column 4, lines 34-37 of the Zakoshansky U.S. Patent No. 5,254,751, acetone and phenol are produced in an essentially 1 to 1 molar ratio in the reaction. If 10 % of the acetone produced is recycled to the decomposition reactor, the molar ratio of acetone to phenol in the reactor would be 1.1 to 1, especially when the final stage of the reaction is reached. If 100 % of the acetone produced is recycled to the decomposition reactor, the molar ratio of acetone to phenol in the reactor would be 2 to 1, especially when the final stage of the reaction is reached. Therefore, Hertzog's recitation encompasses that of Zakoshansky.

In order to further obviate the differences between Zakoshansky claim 1 and Hertzog claim 7, Hertzog claim 10 has been added herein. Hertzog claim 10 recites a particular acetone to phenol ratio (i.e. 1.4:1) which is encompassed within the range (i.e. from 1.1:1 to 1.5:1) recited in Zakoshansky claim 1.

ZAKOSHANSKY CLAIM 2 v. HERTZOG CLAIMS 11-13

The wording of Zakoshansky claim 2, as referred to herein and recited in the claim chart on pages 40-42 hereinafter, is the same as the twice amended version, submitted in the August 17,

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1999 Amendment (Paper No. 17) in the merged Reissue Application Serial No. 08/545,092 and Reexamination Proceeding Control No. 90/004,314.

As shown in the claim chart on pages 40-42 hereinafter, there are only two elements of Zakoshansky claim 2 which are expressed with different wording than used in Hertzog's claim 11.

A first difference is that Zakoshansky claim 2 recites that the decomposition takes place in a "non-isothermal" manner, whereas Hertzog claim 11 does include the expression "non-isothermal".

This difference is not a patentably distinct difference for reasons given above (page 15) in connection with the comparison Zakoshansky claim 1 with Hertzog claim 7. Furthermore, this difference is obviated by the addition of Hertzog claim 12 herein.

The second difference between Zakoshansky claim 2 and Hertzog claim 11 is that these claims use different wording to express the amount of recycled acetone. However, this difference is not a patentably distinct difference for reasons given above (page 17) in connection with the comparison Zakoshansky claim 1 with Hertzog claim 7. Furthermore, this difference is obviated by the addition of Hertzog claim 13 herein.

ZAKOSHANSKY CLAIM 3 v. HERTZOG CLAIMS 14-16

The wording of Zakoshansky claim 3, as referred to herein and recited in the claim chart on pages 43-45 hereinafter, is the same as the amended version, submitted in the August 17, 1999 Amendment (Paper No. 17) in the merged Reissue Application Serial No. 08/545,092 and Reexamination Proceeding Control No. 90/004,314.

As shown in the claim chart on pages 43-45 hereinafter, there are only three elements of Zakoshansky claim 3 which are expressed with different wording than used in Hertzog's claim 14.

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A first difference is that Zakoshansky claim 3 recites that the decomposition takes place in a “non-isothermal” manner, whereas Hertzog claim 14 does include the expression “non-isothermal”.

This difference is not a patentably distinct difference for reasons given above (page 15) in connection with the comparison Zakoshansky claim 1 with Hertzog claim 7. Furthermore, this difference is obviated by the addition of Hertzog claim 15 herein.

The second difference between Zakoshansky claim 3 and Hertzog claim 14 is that these claims use different wording to express the amount of recycled acetone. However, this difference is not a patentably distinct difference for reasons given above (page 17) in connection with the comparison Zakoshansky claim 1 with Hertzog claim 7. Furthermore, this difference is obviated by the addition of Hertzog claim 15 herein.

A third and final difference between Zakoshansky claim 3 and Hertzog claim 14 is that Hertzog claim 14 does not include Zakoshansky’s recitation of a particular algorithm for calculating the amount of acetone to be recycled. However, this difference is not a patentably distinct difference.

As calculated in the footnote below,¹ the algorithm in the Zakoshansky claim corresponds to a recycle of about 40% of the acetone produced. Therefore, Zakoshansky claim 3 is not patentably distinct from Hertzog claim 14. This difference is further obviated by Hertzog claim

¹ Assumptions - G_{chp} = 100 and [CHP] = 83%. Therefore, G_{acetone} = $100 (0.17) (.83) + 40 / (100) (.83) = 14.59$. The total acetone produced (assuming 100% CHP conversion) = $(100) (.83) (\text{MW acetone} / \text{MW CHP}) = (83) (58 / 144) = 33.59$. Therefore, the percent acetone recycled = $(14.59 / 33.59) (100) = 43.64 \%$.

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16, where it is recited that the reactor composition includes 40 percent acetone relative to the amount produced during the reaction.

ZAKOSHANSKY CLAIM 4 v. HERTZOG CLAIMS 17-19

The wording of Zakoshansky claim 4, as referred to herein and recited in the claim chart on pages 46-49 hereinafter, is the same as the twice amended version, submitted in the August 17, 1999 Amendment (Paper No. 17) in the merged Reissue Application Serial No. 08/545,092 and Reexamination Proceeding Control No. 90/004,314.

As shown in the claim chart on pages 46-49 hereinafter, there are only two elements of Zakoshansky claim 4 which are expressed with different wording than used in Hertzog's claim 17.

A first difference is that Zakoshansky claim 4 recites that the decomposition takes place in a "non-isothermal" manner, whereas Hertzog claim 17 does include the expression "non-isothermal".

This difference is not a patentably distinct difference for reasons given above (page 15) in connection with the comparison Zakoshansky claim 1 with Hertzog claim 7. Furthermore, this difference is obviated by the addition of Hertzog claim 18 herein.

The second difference between Zakoshansky claim 4 and Hertzog claim 17 is that these claims use different wording to express the amount of recycled acetone. However, this difference is not a patentably distinct difference for reasons given above (page 17) in connection with the comparison Zakoshansky claim 1 with Hertzog claim 7. Furthermore, this difference is obviated by the addition of Hertzog claim 19 herein.

ZAKOSHANSKY CLAIM 5 v. HERTZOG CLAIM 20

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The wording of Zakoshansky claim 5, as referred to herein and recited in the claim chart on page 50 hereinafter, is the same as the original version, as recited in U.S. Patent No. 5,254,751 and submitted with Reissue Application Serial No. 08/545,092.

As shown in the claim chart on page 50 hereinafter, Zakoshansky claim 5 recites three sequential reactors, whereas Hertzog 20 recites only one reactor. However, the differences between the claims are not patentably distinct differences.

Whether one or three reactors is immaterial and an obvious engineering design choice. It is noted that the temperature can be the same (57°C) in all three of the reactors recited in Zakoshansky claim 5.

ZAKOSHANSKY CLAIM 6 v. HERTZOG CLAIM 21

The wording of Zakoshansky claim 6, as referred to herein and recited in the claim chart on pages 50-51 hereinafter, is the same as the original version, as recited in U.S. Patent No. 5,254,751 and submitted with Reissue Application Serial No. 08/545,092.

As shown in the claim chart on pages 50-51 hereinafter, there is only one element of Zakoshansky claim 6 which is expressed with different wording than used in Hertzog's claim 21.

This difference is that Zakoshansky claim 6 recites that there is a particular delta T°C of 4° to 16°C in the plug flow reactor, whereas Hertzog claim 21 states that the outlet temperature is higher than the inlet temperature of the plug flow reactor.

The temperature at the exit of the plug flow reactor (PFR) is higher than the inlet temperature due to the exothermic decomposition of DCP and CHP and dehydration of DMPC to AMS. See page 9, lines 30-32 of the Hertzog specification. Since the same reactions take place

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in the plug flow reactors of both Zakoshansky and Hertzog, the difference of the respective claims in expressing the consequences of these reactions is immaterial and not patentably distinct.

ZAKOSHANSKY CLAIM 7 v. HERTZOG CLAIM 22

The wording of Zakoshansky claim 7, as referred to herein and recited in the claim chart on page 51 hereinafter, is the same as the twice amended version, submitted in the August 17, 1999 Amendment (Paper No. 17) in the merged Reissue Application Serial No. 08/545,092 and Reexamination Proceeding Control No. 90/004,314.

As shown in the claim chart on page 51 hereinafter, the recitation of Zakoshansky claim 7 is the same as the recitation of Hertzog 22, except Zakoshansky uses the British spelling of "sulphuric", whereas Hertzog uses the American spelling, "sulfuric".

ZAKOSHANSKY CLAIM 8 v. HERTZOG CLAIM 23

The wording of Zakoshansky claim 8, as referred to herein and recited in the claim chart on page 51 hereinafter, is the same as the amended version, submitted in the April 11, 1997 Amendment (Paper No. 9) in the merged Reissue Application Serial No. 08/545,092 and Reexamination Proceeding Control No. 90/004,314.

As shown in the claim chart on page 51 hereinafter, Zakoshansky claim 8 recites that the catalyst concentration is 150 to 600 ppm based on the weight of the cumene hydroperoxide decomposition product, whereas Hertzog 23 recites that the catalyst concentration is 30 to 500 ppm based on the weight of the reaction mass. However, these differences between the claims are not patentably distinct differences.

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If 80 wt% CHP is introduced into the reactor sequence, the weight of the CHP decomposition product would be about 80 % of the weight of the reaction mass. Therefore, the catalyst quantities recited in Zakoshansky claim 8 and Hertzog claim 23 inherently overlap and are not patentably distinct from one another.

ZAKOSHANSKY CLAIM 9 v. HERTZOG CLAIM 24

The wording of Zakoshansky claim 9, as referred to herein and recited in the claim chart on page 51 hereinafter, is the same as the amended version, submitted in the April 11, 1997 Amendment (Paper No. 9) in the merged Reissue Application Serial No. 08/545,092 and Reexamination Proceeding Control No. 90/004,314.

As shown in the claim chart on page 51 hereinafter, Zakoshansky claim 9 recites a reaction temperature of 45° to 75° C, whereas Hertzog claim 24 recites a reaction temperature of 50° to 90° C. Since these temperature ranges overlap, these claims do not recite patentably distinct differences.

ZAKOSHANSKY CLAIM 10 v. HERTZOG CLAIM 25

The wording of Zakoshansky claim 10, as referred to herein and recited in the claim chart on pages 52-54 hereinafter, is the same as the twice amended version, submitted in the August 17, 1999 Amendment (Paper No. 17) in the merged Reissue Application Serial No. 08/545,092 and Reexamination Proceeding Control No. 90/004,314.

As shown in the claim chart on pages 52-54 hereinafter, there are only two elements of Zakoshansky claim 10 which are expressed with different wording than used in Hertzog's claim 25.

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A first difference between Zakoshansky claim 10 and Hertzog claim 25 is that these claims use different wording to express the amount of recycled acetone. However, this difference is not a patentably distinct difference for reasons given above (page 17) in connection with the comparison Zakoshansky claim 1 with Hertzog claim 7.

A second difference between Zakoshansky claim 10 and Hertzog claim 25 is that these claims use different wording to express the amount of CHP remaining after decomposition. However, this difference is not a patentably distinct difference, because the amounts expressed overlap.

ZAKOSHANSKY CLAIM 11 v. HERTZOG CLAIM 26

The wording of Zakoshansky claim 11, as referred to herein and recited in the claim chart on pages 55-57 hereinafter, is the same as the amended version, submitted in the April 11, 1997 Amendment (Paper No. 9) in the merged Reissue Application Serial No. 08/545,092 and Reexamination Proceeding Control No. 90/004,314.

As shown in the claim chart on pages 55-57 hereinafter, there are only two elements of Zakoshansky claim 11 which are expressed with different wording than used in Hertzog's claim 26.

A first difference between Zakoshansky claim 11 and Hertzog claim 26 is that these claims use different wording to express the temperature of step (b) of the reaction. However, this difference is not a patentably distinct difference, because the recited temperatures overlap.

The second difference between Zakoshansky claim 11 and Hertzog claim 26 is that the Hertzog claim 26 does not recite the temperature and pressure used to evaporate acetone.

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However, this difference is not a patentably distinct difference, because the selection of the temperature and pressure used to evaporate acetone is one of obvious engineering design choice.

ZAKOSHANSKY CLAIM 21 v. HERTZOG CLAIMS 27-28

The wording of Zakoshansky claim 21, as referred to herein and recited in the claim chart on pages 58-59 hereinafter, is the same as the amended version, submitted in the April 11, 1997 Amendment (Paper No. 9) in the merged Reissue Application Serial No. 08/545,092 and Reexamination Proceeding Control No. 90/004,314.

As shown in the claim chart on pages 58-59 hereinafter, there is only one element of Zakoshansky claim 21 which is expressed with different wording than used in Hertzog's claim 27.

This difference is that these claims use different wording to express the amount of acetone. However, this difference is not a patentably distinct difference, because the recited amounts overlap. Furthermore, this difference is obviated by the addition of Hertzog claim 28 herein.

ZAKOSHANSKY CLAIM 27 v. HERTZOG CLAIMS 29-30

The wording of Zakoshansky claim 27, as referred to herein and recited in the claim chart on pages 60-63 hereinafter, is the same as the amended version, submitted in the April 11, 1997 Amendment (Paper No. 9) in the merged Reissue Application Serial No. 08/545,092 and Reexamination Proceeding Control No. 90/004,314.

As shown in the claim chart on pages 60-63 hereinafter, there are only two elements of Zakoshansky claim 27 which are expressed with different wording than used in Hertzog's claim 29.

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A first difference is that Hertzog claim 29 does not recite a particular quantity of cumene. However, this difference is not a patentably distinct difference for reasons given above (page 16) in connection with the comparison Zakoshansky claim 1 with Hertzog claim 7. Furthermore, this difference is obviated by the addition of Hertzog claim 30 herein.

The second difference is that Hertzog claim 29 does not recite that step (b) takes place in a weaker catalyst medium than step (a). This recitation is not material.

The number of moles of catalyst remains constant throughout the reaction. However, the total number of moles of other species increases as the decomposition reactions progress. For example, each mole of CHP produces two moles of product (i.e. one mole of acetone and one mole of phenol). Therefore, in terms of the mole ratio of catalyst to reactants and decomposition reaction products, the concentration of the catalyst decreases as the reaction proceeds.

ZAKOSHANSKY CLAIM 28 v. HERTZOG CLAIM 31

The wording of Zakoshansky claim 28, as referred to herein and recited in the claim chart on pages 64-67 hereinafter, is the same as the amended version, submitted in the August 17, 1999 Amendment (Paper No. 17) in the merged Reissue Application Serial No. 08/545,092 and Reexamination Proceeding Control No. 90/004,314.

As shown in the claim chart on pages 64-67 hereinafter, there are number of elements of Zakoshansky claim 28 which are expressed with different wording than used in Hertzog's claim 31.

A first series of three elements in Zakoshansky claim 28, which are not recited in Hertzog claim 28, recite lower acid strength and concentration in step (b). However, this difference is not

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a patentably distinct difference for reasons given above in connection with the comparison Zakoshansky claim 27 with Hertzog claim 29.

Another difference involves the temperature recited for step (a). However, since these temperatures overlap, this difference is not a patentably distinct difference.

Another difference involves the catalyst concentration in step (a). However, this difference is not a patentably distinct difference for reasons given above (pages 22-23) in connection with the comparison Zakoshansky claim 8 with Hertzog claim 23.

Another difference involves the temperature recited for step (b). However, since these temperatures overlap, this difference is not a patentably distinct difference.

ZAKOSHANSKY CLAIMS 30 & 31 v. HERTZOG CLAIM 32

The wording of Zakoshansky claims 30 and 31, as referred to herein and recited in the claim chart on pages 68-70 hereinafter (claim 30) and below (claim 31), is the same as the original versions, as recited in U.S. Patent No. 5,254,751 and submitted with Reissue Application Serial No. 08/545,092.

As shown in the claim chart on pages 68-70 hereinafter, there are only two elements of Zakoshansky claim 30 which are expressed with different wording than used in Hertzog's claim 32.

A first difference is that Hertzog claim 32 recites that the feed to the plug flow reactor exits from the outlet stream of a "back mixed" reactor, whereas Zakoshansky claim 30 recites that this feed exits from the outlet stream of a "last sequential" reactor. This difference is not a patentably distinct difference.

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Whether or not multiple sequential reactors are used in the first stage is a matter of obvious engineering design choice. It is further noted that considerable recycle takes place in the sequential reactors of Zakoshansky. Therefore, these sequential reactors are essentially back mixed reactors with three compartments connected in series.

The second difference is that Zakoshansky claim 30 recites that there is a particular delta T°C of 4° to 16°C in the plug flow reactor, whereas Hertzog claim 32 states that the outlet temperature is higher than the inlet temperature of the plug flow reactor. However, this difference is not a patentably distinct difference for reasons given above (pages 21-22) in connection with the comparison Zakoshansky claim 6 with Hertzog claim 21.

Zakoshansky claim 31 is dependent from Zakoshansky claim 30 and fails to add a material limitation to Zakoshansky claim 30. In particular, Zakoshansky claim 31 states as follows:

31. The method in accordance with claim 30 wherein the delta T°C. is from about 5° to 15° C.

The delta T°C range of 5-15 °C, recited in claim 31, is not patentably distinct from the delta T°C range of 4-16 °C, recited in claim 30.

ZAKOSHANSKY CLAIM 33 v. HERTZOG CLAIM 33

The wording of Zakoshansky claim 33, as referred to herein and recited in the claim chart on pages 71-73 hereinafter, is the same as the amended version, submitted in the April 11, 1997 Amendment (Paper No. 9) in the merged Reissue Application Serial No. 08/545,092 and Reexamination Proceeding Control No. 90/004,314.

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As shown in the claim chart on pages 71-73 hereinafter, there are only two elements of Zakoshansky claim 33 which are expressed with different wording than used in Hertzog's claim 33.

A first difference is that Hertzog claim 33 does not recite the quantity of recycled decomposition products. However, this difference is not a patentably distinct difference.

The rate of recycle is a matter of obvious engineering design choice. Furthermore, both Zakoshansky and Hertzog use essentially the same feed (e.g., technical CHP) to step (a) and maintain essentially the same low levels of CHP in the overall reaction mass of step (a). Therefore, the rates of recycle of decomposition products must be essentially the same.

The second difference between Zakoshansky claim 33 and Hertzog claim 33 is that these claims use different wording to express the amount of recycled acetone. However, this difference is not a patentably distinct difference for reasons given above (page 17) in connection with the comparison Zakoshansky claim 1 with Hertzog claim 7.

ZAKOSHANSKY CLAIM 34 v. HERTZOG CLAIM 34

The wording of Zakoshansky claim 34, as referred to herein and recited in the claim chart on page 74 hereinafter, is the same as the original version, as recited in U.S. Patent No. 5,254,751 and submitted with Reissue Application Serial No. 08/545,092.

As shown in the claim chart on page 74 hereinafter, Zakoshansky claim 34 recites a water level of not greater than 3 wt%, whereas Hertzog claim 34 recites a water level of not greater than 4 wt%. Since these weight percentages overlap, these claims do not recite patentably distinct differences.

ZAKOSHANSKY CLAIM 35 v. HERTZOG CLAIM 35

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The wording of Zakoshansky claim 35, as referred to herein and recited in the claim chart on page 74 hereinafter, is the same as the original version, as recited in U.S. Patent No. 5,254,751 and submitted with Reissue Application Serial No. 08/545,092.

As shown in the claim chart on page 74 hereinafter, Zakoshansky claim 35 recites a water level of not greater than 2 wt%, whereas Hertzog claim 34 recites a water level of between 0.03 and 1.34 wt%. Since these weight percentages overlap, these claims do not recite patentably distinct differences.

ZAKOSHANSKY CLAIM 36 v. HERTZOG CLAIM 35

The wording of Zakoshansky claim 36, as referred to herein and recited in the claim chart on page 74 hereinafter, is the same as the original version, as recited in U.S. Patent No. 5,254,751 and submitted with Reissue Application Serial No. 08/545,092.

As shown in the claim chart on page 74 hereinafter, Zakoshansky claim 36 recites a water level of not greater than 1.5 wt%, whereas Hertzog claim 34 recites a water level of between 0.03 and 1.34 wt%. Since these weight percentags overlap, these claims do not recite patentably distinct differences.

ZAKOSHANSKY CLAIM 37 v. HERTZOG CLAIMS 36-38

The wording of Zakoshansky claim 37, as referred to herein and recited in the claim chart on pages 75-77 hereinafter, is the same as the amended version, submitted in the April 11, 1997 Amendment (Paper No. 9) in the merged Reissue Application Serial No. 08/545,092 and Reexamination Proceeding Control No. 90/004,314.

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As shown in the claim chart on pages 75-77 hereinafter, there are only two elements of Zakoshansky claim 37 which are expressed with different wording than used in Hertzog's claim 36.

A first difference is that Zakoshansky claim 37 recites that the decomposition takes place in a "non-isothermal" manner, whereas Hertzog claim 36 does include the expression "non-isothermal".

This difference is not a patentably distinct difference for reasons given above (page 15) in connection with the comparison Zakoshansky claim 1 with Hertzog claim 7. Furthermore, this difference is obviated by the addition of Hertzog claim 37 herein.

The second difference between Zakoshansky claim 37 and Hertzog claim 36 is that Hertzog claim 36 does not recite the amount of cumene in the reactor composition. However, this difference is not a patentably distinct difference for reasons given above (page 16) in connection with the comparison Zakoshansky claim 1 with Hertzog claim 7. Furthermore, this difference is obviated by the addition of Hertzog claim 38 herein.

ZAKOSHANSKY CLAIM 38 v. HERTZOG CLAIMS 39-42

The wording of Zakoshansky claim 38, as referred to herein and recited in the claim chart on pages 78-80 hereinafter, is the same as the twice amended version, submitted in the August 17, 1999 Amendment (Paper No. 17) in the merged Reissue Application Serial No. 08/545,092 and Reexamination Proceeding Control No. 90/004,314.

As shown in the claim chart on pages 78-80 hereinafter, there are only three elements of Zakoshansky claim 38 which are expressed with different wording than used in Hertzog's claim 39.

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A first difference is that Zakoshansky claim 38 recites that the decomposition takes place in a “non-isothermal” manner, whereas Hertzog claim 39 does include the expression “non-isothermal”.

This difference is not a patentably distinct difference for reasons given above (page 15) in connection with the comparison Zakoshansky claim 1 with Hertzog claim 7. Furthermore, this difference is obviated by the addition of Hertzog claim 40 herein.

The second difference between Zakoshansky claim 38 and Hertzog claim 39 is that these claims use different wording to express the amount of recycled acetone. However, this difference is not a patentably distinct difference for reasons given above (page 17) in connection with the comparison Zakoshansky claim 1 with Hertzog claim 7. Furthermore, this difference is obviated by the addition of Hertzog claim 41 herein.

The third difference between Zakoshansky claim 38 and Hertzog claim 39 is that Hertzog claim 39 does not recite the amount of cumene in the reactor composition. However, this difference is not a patentably distinct difference for reasons given above (page 16) in connection with the comparison Zakoshansky claim 1 with Hertzog claim 7. Furthermore, this difference is obviated by the addition of Hertzog claim 42 herein.

ZAKOSHANSKY CLAIM 39 v. HERTZOG CLAIMS 43

The wording of Zakoshansky claim 39, as referred to herein and recited in the claim chart on pages 81-82 hereinafter, is the same as the original version, as recited in U.S. Patent No. 5,254,751 and submitted with Reissue Application Serial No. 08/545,092.

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As shown in the claim chart on pages 81-82 hereinafter, the wording of Zakoshansky claim 39 is identical to the wording of Hertzog claim 43.

**ZAKOSHANSKY'S CLAIMS WERE HELD TO BE ALLOWABLE OVER PRIOR ART
OF RECORD PRIOR TO AUGUST 17, 1999**

In an Official Action (Paper No. 11), mailed January 30, 1998, in the merged Reissue Application Serial No. 08/545,092 and Reexamination Proceeding Control No. 90/004,314, Zakoshansky's application was held to be in a condition for allowance. Therefore, Zakoshansky's claims then pending were examined on the merits and were determined by the Examiner to be novel and non-obvious over the art considered, including that made of record.

On June 8, 1998, the Examiner in the merged reissue/reexamination acknowledged consideration of prior art cited in form PTO-1449, in connection with a Supplemental Information Disclosure Statement, filed March 30, 1998. No claim of Zakoshansky was rejected over this prior art.

On August 17, 1999, Zakoshansky submitted an Amendment (Paper No 17), further amending claims 1-4, 7, 10, 28 and 38. These amendments serve to narrow the claims and do not broaden them in any way. Therefore, these amended claims would be no less allowable over the prior art of record than the previous versions of these claims.

Accompanying the Amendment (Paper No. 17) was another Supplemental Information Disclosure Statement (Paper No. 19), including references and another form PTO-1449. The undersigned has recently checked the status of the merged/reissue, but has not found any document dated later than August 17, 1999. Therefore, the undersigned does not know whether

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the references accompanying the Supplemental IDS (Paper No. 19) have been considered or applied against any claim.

**HERTZOG HAS PREVIOUSLY SUBSTANTIALLY COPIED CLAIMS FROM
ZAKOSHANSKY'S PATENT**

The Zakoshansky U.S. Patent No. 5,254,751 issued on October 19, 1993. Within one year of this issue date on February 28, 1994, Hertzog submitted a Preliminary Amendment in concurrently filed Serial No. 08/203,845, wherein a number of Zakoshansky's claims were substantially copied. The Hertzog claims are currently pending on appeal in Serial No. 08/601,879, filed February 15, 1996, which is a continuation of the above mentioned Serial No. 08/203,845.

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CLAIM CHART

ZAKOSHANSKY CLAIM 1	HERTZOG CLAIM 7	COMMENT
1. An improved method	7. An improved method	The Hertzog specification describes an improved method. Particular improvements include relatively high yields of AMS with low residual CHP (page 4, lines 14-18), as well as enhanced safety and reduced by-product formation (page 4, lines 28-30).
for the decomposition of cumene hydroperoxide	for the decomposition of cumene hydroperoxide	The Hertzog specification describes the decomposition of cumene hydroperoxide. See page 4, lines 9-13, 26 and 31.
by acidic catalyst	by acidic catalyst	The Hertzog specification describes the use of an acid catalyst. See page 4, line 32; page 5, line 30; and page 6, lines 10-16.
to phenol and acetone	to phenol and acetone	The Hertzog specification describes the decomposition of cumene hydroperoxide to produce phenol and acetone. See page 4, line 27 and page 5, line 38.
wherein the improvement comprises decomposing cumene hydroperoxide	wherein the improvement comprises decomposing cumene hydroperoxide	The Hertzog specification describes the decomposition of cumene hydroperoxide. See page 4, lines 9-13, 26 and 31.
in a continuous	in a continuous	The Hertzog specification describes a continuous method. In particular, it is pointed out that the reaction can reach a steady state. See page 10, line 36 and

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		page 11, line 3. Furthermore, at page 1, lines 6-11, it is pointed out that commercial scale methods are carried out in a continuous manner.
non-isothermal manner	manner	The Hertzog specification describes a non-isothermal reaction. However, it is immaterial whether the reaction is run in a isothermal or non-isothermal manner. See explanation in footnote below. ² Furthermore, a non-isothermal reaction is recited in Hertzog claim 8.
in a decomposition reactor	in a decomposition reactor	The Hertzog specification describes the decomposition of cumene hydroperoxide in a decomposition reactor. See page 4, line 32 and page 5, lines 31-32.
using sulfuric acid as the acidic catalyst	using sulfuric acid as the acidic catalyst	The Hertzog specification describes the use of sulfuric acid as the acid catalyst. See page 6, lines 10-16 and page 10, line 24.
in the presence of cumene	in the presence of cumene	The Hertzog specification describes the decomposition of cumene hydroperoxide in the presence of cumene. See page 10, lines 17 & 22.

² Whether or not the reaction is run in a non-isothermal manner is immaterial, because page 7, lines 13-25 of the Hertzog specification points out that "an almost infinite variety of reaction conditions" can be used. Furthermore, at column 4, lines 28-30 of the Zakoshansky U.S. Patent No. 5,254,751, isothermal reaction conditions are equated to constant boiling or refluxing type systems, which are not disclosed in the Hertzog specification, and which would not be practical for use in a system wherein acetone is to be recycled.

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in an amount of about 10 to 18 weight percent of the reactor composition		The Hertzog specification describes the decomposition of cumene hydroperoxide in the presence of cumene, wherein the amount of cumene is within the range of about 10 to 18 weight percent of the reactor composition. However, this particular quantity of cumene is an immaterial limitation. See the explanation in the footnote below. ³ Furthermore, a particular quantity of cumene falling within this range is recited in Hertzog claim 9.
and excess acetone	and excess acetone	The Hertzog specification describes the decomposition of cumene hydroperoxide in the presence of excess acetone. See page 4, lines 14, 19 & 33.
whereby the molar ratio of acetone to phenol in the reactor composition is from about 1.1:1 to 1.5:1	whereby the reactor composition includes 10 to 100 percent excess acetone relative to the amount of	The Hertzog specification describes the addition of 10 to 100 percent acetone relative to the amount of

³ As a practical matter, it would be difficult to avoid the presence of from about 10 to 18 weight percent of cumene in the decomposition reactor. Cumene hydroperoxide is typically produced by oxidizing cumene. Residual, unreacted cumene, in an amount of from 10 to 18 weight percent, is typically included in the cumene hydroperoxide. For example, at column 6, line 67 to column 7, line 1 of the Sifniades U.S. Patent No. 4,358,618, there is described a technical cumene hydroperoxide (CHP) containing 83 wt% CHP, 3.2 wt% "carbinol" (a.k.a. dimethylphenyl carbinol, DMPC, dimethylbenzyl alcohol, and DMBA) and 0.4 wt% acetophenone with the balance (i.e. 13.4 wt%) being cumene. Similarly, at column 7, lines 65-67 of the Zakoshansky U.S. Patent No. 5,254,751, there is described a technical cumene hydroperoxide (CHP) containing 83.80 wt% CHP, 3.64 wt% DMBA, 0.40 wt% acetophenone and 12.16 wt% cumene. A similar cumene oxidation product is described at page 10, lines 14-17 of the Hertzog specification and has 81.6 wt% CHP, 5.00 wt% DMPC and 0.40 wt% acetophenone, with the balance (i.e. 13 wt.%) being mostly cumene.

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	acetone produced during the reaction	acetone produced during the reaction to the decomposition reactor. See page 4, lines 31-34. There is a difference in wording of the respective recitations in Zakoshansky claim 1 and the Hertzog claim 7. However, this difference is not patentably distinct, as explained in the footnote below. ⁴ Furthermore, Hertzog claim 10 recites a particular ratio of acetone to phenol falling within Zakoshansky's recitation.
whereby the rate of decomposition of cumene hydroperoxide is reduced	whereby the rate of decomposition of cumene hydroperoxide is reduced	The addition of a diluent (i.e. acetone) to a reaction mixture inherently reduces the rate of the reaction. This reduced rate of reaction is suggested at page 7, lines 30-32 of the Hertzog specification.
and the reaction is more controllable	and the reaction is more controllable	The Hertzog specification describes a reaction which is more controllable. In particular, stability and enhanced safety are discussed. See page 4, lines 12 & 28.
and more selective.	and more selective.	The Hertzog specification describes a reaction which is

⁴ As pointed out at column 4, lines 34-37 of the Zakoshansky U.S. Patent No. 5,254,751, acetone and phenol are produced in an essentially 1 to 1 molar ratio in the reaction. If 10 % of the acetone produced is recycled to the decomposition reactor, the molar ratio of acetone to phenol in the reactor would be 1.1 to 1. If 100 % of the acetone produced is recycled to the decomposition reactor, the molar ratio of acetone to phenol in the reactor would be 2 to 1. Therefore, Hertzog's recitation encompasses that of Zakoshansky.

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		more selective. See page 4, lines 17-18 and Fig. 2.
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ZAKOSHANSKY CLAIM 2	HERTZOG CLAIM 11	COMMENT
2. An improved method	11. An improved method	The Hertzog specification describes an improved method. Particular improvements include relatively high yields of AMS with low residual CHP (page 4, lines 14-18), as well as enhanced safety and reduced by-product formation (page 4, lines 28-30).
for the decomposition of cumene hydroperoxide	for the decomposition of cumene hydroperoxide	The Hertzog specification describes the decomposition of cumene hydroperoxide. See page 4, lines 9-13, 26 and 31.
by acidic catalyst	by acidic catalyst	The Hertzog specification describes the use of an acid catalyst. See page 4, line 32; page 5, line 30 and page 6, lines 10-16.
to phenol and acetone	to phenol and acetone	The Hertzog specification describes the decomposition of cumene hydroperoxide to produce phenol and acetone. See page 4, line 27; and page 5, line 38.
wherein the improvement comprises decomposing cumene hydroperoxide	wherein the improvement comprises decomposing cumene hydroperoxide	The Hertzog specification describes the decomposition of cumene hydroperoxide. See page 4, lines 9-13, 26 and 31.
in a continuous	in a continuous	The Hertzog specification describes a continuous method. In particular, it is pointed out that the reaction can reach a steady state. See page 10, line 36 and page 11, line 3. Furthermore, at page 1, lines 6-11, it is pointed out

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		that commercial scale methods are carried out in a continuous manner.
non-isothermal manner	manner	The Hertzog specification describes a non-isothermal reaction. However, it is immaterial whether the reaction is run in a isothermal or non-isothermal manner. See explanation in footnote below. ⁵ Furthermore, a non-isothermal reaction is recited in Hertzog claim 12.
using sulfuric acid as the acidic catalyst	using sulfuric acid as the acidic catalyst	The Hertzog specification describes the use of sulfuric acid as the catalyst. See page 6, lines 10-16; page 10, line 24.
in the presence of excess acetone,	in the presence of excess acetone,	The Hertzog specification describes the decomposition of cumene hydroperoxide in the presence of excess acetone. See page 4, lines 14, 19 & 33.
wherein the acetone is thoroughly mixed with the cumene hydroperoxide feedstream	wherein the acetone is thoroughly mixed with the cumene hydroperoxide feedstream	The Hertzog specification describes the thorough mixing of acetone with cumene hydroperoxide. See page 5, lines 29-32.
and the molar ratio of acetone to phenol in the reactor composition is from about 1.1:1 to 1.5:1	and the reactor composition includes 10 to 100 percent excess acetone relative to the amount of acetone produced	The Hertzog specification describes the addition of 10 to 100 percent acetone relative to the amount of acetone

⁵ Whether or not the reaction is run in a non-isothermal manner is immaterial, because page 7, lines 13--25 of the Hertzog specification points out that "an almost infinite variety of reaction conditions" can be used. Furthermore, at column 4, lines 28-30 of the Zakoshansky U.S. Patent No. 5,254,751, isothermal reaction conditions are equated to constant boiling or refluxing type systems, which are not disclosed in the Hertzog specification, and which would not be practical for use in a system wherein acetone is to be recycled.

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	during the reaction	produced during the reaction to the decomposition reactor. See page 4, lines 31-34. There is a difference in wording of the respective recitations in Zakoshansky claim 2 and the Hertzog claim 11. However, this difference is not patentably distinct, as explained in the footnote below. ⁶ Furthermore, Hertzog claim 13 recites a particular ratio of acetone to phenol falling within Zakoshansky's recitation.
whereby the rate of decomposition of cumene hydroperoxide is reduced	whereby the rate of decomposition of cumene hydroperoxide is reduced	The addition of a diluent (i.e. acetone) to a reaction mixture inherently reduces the rate of the reaction. This reduced rate of reaction is suggested at page 7, lines 30-32 of the Hertzog specification.
and the reaction is more controllable	and the reaction is more controllable	The Hertzog specification describes a reaction which is more controllable. In particular, stability and enhanced safety are discussed. See page 4, lines 12 & 28.
and more selective.	and more selective.	The Hertzog specification describes a reaction which is more selective. See page 4, lines 17-18 and Fig. 2.

⁶ As pointed out at column 4, lines 34-37 of the Zakoshansky U.S. Patent No. 5,254,751, acetone and phenol are produced in an essentially 1 to 1 molar ratio in the reaction. If 10 % of the acetone produced is recycled to the decomposition reactor, the molar ratio of acetone to phenol in the reactor would be 1.1 to 1. If 100 % of the acetone produced is recycled to the decomposition reactor, the molar ratio of acetone to phenol in the reactor would be 2 to 1. Therefore, Hertzog's recitation encompasses that of Zakoshansky.

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ZAKOSHANSKY CLAIM 3	HERTZOG CLAIM 14	COMMENT
3. An improved method	14. An improved method	The Hertzog specification describes an improved method. Particular improvements include relatively high yields of AMS with low residual CHP (page 4, lines 14-18), as well as enhanced safety and reduced by-product formation (page 4, lines 28-30).
for the decomposition of cumene hydroperoxide	for the decomposition of cumene hydroperoxide	The Hertzog specification describes the decomposition of cumene hydroperoxide. See page 4, lines 9-13, 26 and 31.
by acidic catalyst	by acidic catalyst	The Hertzog specification describes the use of an acid catalyst. See page 4, line 32; page 5, line 30; and page 6, lines 10-16.
to phenol and acetone	to phenol and acetone	The Hertzog specification describes the decomposition of cumene hydroperoxide to produce phenol and acetone. See page 4, line 27 and page 5, line 38.
wherein the improvement comprises decomposing cumene hydroperoxide	wherein the improvement comprises decomposing cumene hydroperoxide	The Hertzog specification describes the decomposition of cumene hydroperoxide. See page 4, lines 9-13, 26 and 31.
in a non-isothermal manner		The Hertzog specification describes a non-isothermal reaction. However, it is immaterial whether the reaction is run in a isothermal or non-isothermal manner.

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		See explanation in footnote below. ⁷ Furthermore, a non-isothermal reaction is recited in Hertzog claim 15.
in the presence of excess acetone	in the presence of excess acetone	The Hertzog specification describes the decomposition of cumene hydroperoxide in the presence of excess acetone. See page 4, lines 14, 19 & 33.
whereby the molar ratio of acetone to phenol in the reactor composition is from about 1.1:1 to 1.5:1	whereby the reactor composition includes 10 to 100 percent excess acetone relative to the amount of acetone produced during the reaction	The Hertzog specification describes the addition of 10 to 100 percent acetone relative to the amount of acetone produced during the reaction to the decomposition reactor. See page 4, lines 31-34. There is a difference in wording of the respective recitations in Zakoshansky claim 3 and the Hertzog claim 14. However, this difference is not patentably distinct, as explained in the footnote below. ⁸ Furthermore, Hertzog claim 12 recites a particular ratio of acetone to phenol

⁷ Whether or not the reaction is run in a non-isothermal manner is immaterial, because page 7, lines 13--25 of the Hertzog specification points out that "an almost infinite variety of reaction conditions" can be used. Furthermore, at column 4, lines 28-30 of the Zakoshansky U.S. Patent No. 5,254,751, isothermal reaction conditions are equated to constant boiling or refluxing type systems, which are not disclosed in the Hertzog specification, and which would not be practical for use in a system wherein acetone is to be recycled.

⁸ As pointed out at column 4, lines 34-37 of the Zakoshansky U.S. Patent No. 5,254,751, acetone and phenol are produced in an essentially 1 to 1 molar ratio in the reaction. If 10 % of the acetone produced is recycled to the decomposition reactor, the molar ratio of acetone to phenol in the reactor would be 1.1 to 1. If 100 % of the acetone produced is recycled to the decomposition reactor, the molar ratio of acetone to phenol in the reactor would be 2 to 1. Therefore, Hertzog's recitation encompasses that of Zakoshansky.

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		falling within Zakoshansky's recitation.
whereby the rate of decomposition of cumene hydroperoxide is reduced	whereby the rate of decomposition of cumene hydroperoxide is reduced	The addition of a diluent (i.e. acetone) to a reaction mixture inherently reduces the rate of the reaction. This reduced rate of reaction is suggested at page 7, lines 30-32 of the Hertzog specification.
and the reaction is more controllable	and the reaction is more controllable	The Hertzog specification describes a reaction which is more controllable. In particular, stability and enhanced safety are discussed. See page 4, lines 12 & 28.
and more selective	and more selective.	The Hertzog specification describes a reaction which is more selective. See page 4, lines 17-18 and Fig. 2.
<p>wherein the excess acetone is added in accordance with the algorithm</p> $G_{\text{acetone}} = G_{\text{chp}}(0.17)([\text{CHP}]) + 40 / (G_{\text{chp}}[\text{CHP}])$ <p>where G acetone is the quantity of fed acetone, metric ton/hour; G_{chp} is quantity of technical cumene hydroperoxide fed to the unit, metric ton/hour; and [CHP] is concentration in technical cumene hydroperoxide, weight %/100.</p>		As calculated in the footnote below, ² the algorithm in the Zakoshansky claim corresponds to a recycle of about 40% of the acetone produced. Therefore, Zakoshansky claim 3 is not patentably distinct from Hertzog claim 14. See also Hertzog claim 16, where it is recited that the reactor composition includes 40 percent acetone relative to the amount produced during the reaction. See page 10, lines 28-29.

² Assumptions - G_{chp} = 100 and [CHP] = 83%. Therefore, G_{acetone} = 100 (0.17) (.83) + 40 / (100) (.83) = 14.59. The total acetone produced (assuming 100% CHP conversion) = (100) (.83) (MW acetone / MW CHP) = (83) (58 / 144) = 33.59. Therefore, the percent acetone recycled = (14.59 / 33.59) (100) = 43.64 %.

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ZAKOSHANSKY CLAIM 4	HERTZOG CLAIM 17	COMMENT
4. An improved method	17. An improved method	The Hertzog specification describes an improved method. Particular improvements include relatively high yields of AMS with low residual CHP (page 4, lines 14-18), as well as enhanced safety and reduced by-product formation (page 4, lines 28-30).
for the decomposition of cumene hydroperoxide	for the decomposition of cumene hydroperoxide	The Hertzog specification describes the decomposition of cumene hydroperoxide. See page 4, lines 9-13, 26 and 31.
by acidic catalyst	by acidic catalyst	The Hertzog specification describes the use of an acid catalyst. See page 4, line 32; page 5, line 30; and page 6, lines 10-16.
to phenol and acetone	to phenol and acetone	The Hertzog specification describes the decomposition of cumene hydroperoxide to produce phenol and acetone. See page 4, line 27 and page 5, line 38.
wherein the improvement comprises decomposing cumene hydroperoxide	wherein the improvement comprises decomposing cumene hydroperoxide	The Hertzog specification describes the decomposition of cumene hydroperoxide. See page 4, lines 9-13, 26 and 31.
in a non-isothermal manner		The Hertzog specification describes a non-isothermal reaction. However, it is immaterial whether the reaction is run in a isothermal or non-isothermal manner.

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		See explanation in footnote below. ¹⁰ Furthermore, a non-isothermal reaction is recited in Hertzog claim 18.
in the presence of excess acetone	in the presence of excess acetone	The Hertzog specification describes the decomposition of cumene hydroperoxide in the presence of excess acetone. See page 4, lines 14, 19 & 33.
in a multiplicity of separate sequential reactors	in a multiplicity of separate sequential reactors	The Hertzog specification describes a multiplicity of separate reactors connected in sequence. Referring to Figure 1, reactor 1 is connected in sequence to pipe 7, which passes through heater 8, and exits into plug flow reactor 9. See page 9, lines 16-29. Therefore, reactor 1 and plug flow reactor 9 are connected in sequence. Furthermore, insofar as reactions can take place within pipe 7 (see page 9, lines 17-20) and heater 8 (see page 9, lines 27-29), these zones may also be considered to be reactors.
each with a controlled temperature range	each with a controlled temperature range	The temperature of reactants is controlled throughout sequence of reactors described in the Hertzog specification. For example, the temperature

¹⁰ Whether or not the reaction is run in a non-isothermal manner is immaterial, because page 7, lines 13-25 of the Hertzog specification points out that "an almost infinite variety of reaction conditions" can be used. Furthermore, at column 4, lines 28-30 of the Zakoshansky U.S. Patent No. 5,254,751, isothermal reaction conditions are equated to constant boiling or refluxing type systems, which are not disclosed in the Hertzog specification, and which would not be practical for use in a system wherein acetone is to be recycled.

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		in reactor 1 is controlled to be within the range of 50 °C to 90 °C (see page 8, lines 35-38), and the temperature in plug flow reactor 9 is controlled to be within the range of 120 °C to 150 °C. See page 9, lines 25-29.
whereby the molar ratio of acetone to phenol in a decomposition reactor composition is from about 1.1:1 to 1.5:1	whereby the reactor composition includes 10 to 100 percent excess acetone relative to the amount of acetone produced during the reaction	The Hertzog specification describes the addition of 10 to 100 percent acetone relative to the amount of acetone produced during the reaction to the decomposition reactor. See page 4, lines 31-34. There is a difference in wording of the respective recitations in Zakoshansky claim 4 and the Hertzog claim 17. However, this difference is not patentably distinct, as explained in the footnote below. ¹¹ Furthermore, Hertzog claim 19 recites a particular ratio of acetone to phenol falling within Zakoshansky's recitation
whereby the rate of decomposition of cumene hydroperoxide is reduced	whereby the rate of decomposition of cumene hydroperoxide is reduced	The addition of a diluent (i.e. acetone) to a reaction mixture inherently reduces the rate of the reaction. This reduced rate of reaction is suggested at page 7, lines 30-32 of the

¹¹ As pointed out at column 4, lines 34-37 of the Zakoshansky U.S. Patent No. 5,254,751, acetone and phenol are produced in an essentially 1 to 1 molar ratio in the reaction. If 10 % of the acetone produced is recycled to the decomposition reactor, the molar ratio of acetone to phenol in the reactor would be 1.1 to 1. If 100 % of the acetone produced is recycled to the decomposition reactor, the molar ratio of acetone to phenol in the reactor would be 2 to 1. Therefore, Hertzog's recitation encompasses that of Zakoshansky.

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		Hertzog specification.
and the reaction is more controllable	and the reaction is more controllable	The Hertzog specification describes a reaction which is more controllable. In particular, stability and enhanced safety are discussed. See page 4, lines 12 & 28.
and more selective.	and more selective.	The Hertzog specification describes a reaction which is more selective. See page 4, lines 17-18 and Fig. 2.

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ZAKOSHANSKY CLAIM 5	HERTZOG CLAIM 20	COMMENT
5. The method in accordance with claim 4, wherein a first reactor is operated in a temperature range of about 50° to 62° C. a second reactor in a temperature range of about 62° to 57° C. and last reactor in a temperature range of about 57° to 50° C.	20. The method in accordance with claim 19, wherein a first reactor is operated in a temperature range of about 50°C to about 90°C.	The Hertzog specification describes a cumene hydroperoxide decomposition with a temperature of about 50° to 90° C. See page 4, lines 35-36. Whether one or three reactors is immaterial and an obvious engineering design choice. It is noted that the temperature can be the same (57°C) in all three of the reactors recited in Zakoshansky claim 5.

ZAKOSHANSKY CLAIM 6	HERTZOG CLAIM 21	COMMENT
6. The method in accordance with claim 4, wherein the outlet stream of the last sequential reactor is passed into a reactor of plug flow design	21. The method in accordance with claim 19, wherein the outlet stream of a decomposition reactor is passed into a reactor of plug flow design	The Hertzog patent describes a process that uses a plug flow reactor in part (b). See p. 5, lines 5 & 37.
and smaller size compared to the decomposition reactor	and smaller size compared to the decomposition reactor	The Hertzog patent describes an example that uses a reactor in step (a) with a residence time of 16 min and a volume of 30 ml (See p. 10, line 20, 32) and a reactor in step (b) with a residence time of 1.6 min. See page 10, line 35. The volume in reactor (b) can be estimated to be around 3 ml. See footnote ¹²

¹² If the system is at steady-state with no overflow from reactor (a), the flow rate into reactor (b) will be 1.85 g/min (1.62+0.23 g/min into reactor (a)). The residence time in reactor (b) is 1.6 min so the grams into reactor (b) = 2.96 g (1.6 min * (1.85 g/min). If the density of the liquid is estimated at 1 g/cm³, the volume is 2.96 cm³ or 2.96 ml.

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wherein the delta T°C. of the inlet temperature and the outlet temperature of said plug flow reactor is from about 4° to 16° C.	wherein the outlet temperature of the plug flow reactor is higher than the inlet temperature of the plug flow reactor.	The Hertzog patent describes a process where the temperature at the exit of the plug flow reactor (PFR) is higher than the inlet temperature due to the exothermic decomposition of DCP and CHP and dehydration of DMPC to AMS. See page 9, lines 30-32.
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ZAKOSHANSKY CLAIM 7	HERTZOG CLAIM 22	COMMENT
7. The method in accordance with claim 4, wherein the acidic catalyst is sulphuric acid.	22. The method in accordance with claim 19, wherein the acidic catalyst is sulfuric acid.	The Hertzog specification describes the use of sulfuric acid as the catalyst. See page 6, lines 10-16; page 10, line 24.

ZAKOSHANSKY CLAIM 8	HERTZOG CLAIM 23	COMMENT
8. The method in accordance with claim 2 wherein the catalyst is in a concentration of from about 150 to 600 ppm of the weight of cumene hydroperoxide decomposition product.	23. The method in accordance with claim 11 wherein the catalyst is in a concentration of from about 30 to 500 ppm of the weight of the reaction mass.	The Hertzog specification describes a catalyst concentration of from about 30 to 500 ppm of the reaction mass. See page 6, lines 15-16.

ZAKOSHANSKY CLAIM 9	HERTZOG CLAIM 24	COMMENT
9. The method in accordance with claim 2 wherein the temperature of the cumene hydroperoxide decomposition is about 45° to 75° C.	24. The method in accordance with claim 11 wherein the temperature of the cumene hydroperoxide decomposition is about 50° to 90° C.	The Hertzog specification describes a cumene hydroperoxide decomposition with a temperature of about 50° to 90° C. See page 4, lines 35-36.

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ZAKOSHANSKY CLAIM 10	HERTZOG CLAIM 25	COMMENT
10. An improved method for the decomposition of cumene hydroperoxide	25. An improved method for the decomposition of cumene hydroperoxide	The Hertzog specification describes the use of sulfuric acid as the catalyst. See page 6, lines 10-16; page 10, line 24. The Hertzog specification describes the decomposition of cumene hydroperoxide. See page 4, lines 9-13, 26 and 31.
by acidic catalyst	by acidic catalyst	The Hertzog specification describes the use of an acid catalyst. See page 4, line 32; page 5, line 30; and page 6, lines 10-16.
to phenol and acetone	to phenol and acetone	The Hertzog specification describes the decomposition of cumene hydroperoxide to produce phenol and acetone. See page 4, line 27 and page 5, line 38.
wherein the improvement comprises decomposing cumene hydroperoxide	wherein the improvement comprises decomposing cumene hydroperoxide	The Hertzog specification describes the decomposition of cumene hydroperoxide. See page 4, lines 9-13, 26 and 31.
in a continuous	in a continuous	The Hertzog specification describes a continuous method. In particular, it is pointed out that the reaction can reach a steady state. See page 10, line 36 and page 11, line 3. Furthermore, at page 1, lines 6-11, it is pointed out that commercial scale methods are carried out in a continuous manner.
non-isothermal manner	non-isothermal manner	The Hertzog specification describes a non-isothermal

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		<p>reaction. This recitation is supported the passage of the Hertzog specification extending from page 4, line 24 to page 5, line 7, wherein it is stated that step (a) of the decomposition reaction takes place at 50°C to 90°C (see page 4, line 36) and then the temperature is increased to 120°C to 150°C (see page 5, line 4) in step (b). It is further stated in the passage extending from page 7, line 37 to page 8, line 3 that temperature gradients exist in step (a) when a back-mixed reactor is used.</p>
using sulfuric acid as the acidic catalyst	using sulfuric acid as the acidic catalyst	<p>The Hertzog specification describes the use of sulfuric acid as the catalyst. See page 6, lines 10-16; page 10, line 24.</p>
in the presence of excess acetone	in the presence of excess acetone	<p>The Hertzog specification describes the decomposition of cumene hydroperoxide in the presence of excess acetone. See page 4, lines 14, 19 & 33.</p>
whereby the molar ratio of acetone to phenol in a decomposition reactor composition is from about 1.1:1 to 1.5:1	whereby the reactor composition includes 10 to 100 percent excess acetone relative to the amount of acetone produced during the reaction	<p>The Hertzog specification describes the addition of 10 to 100 percent acetone relative to the amount of acetone produced during the reaction to the decomposition reactor. See page 4, lines 31-34. There is a difference in wording of the respective recitations in Zakoshansky claim 10 and the Hertzog claim 25. However, this difference is not patentably distinct, as</p>

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		explained in the footnote below. ¹³
wherein the quantity of cumene hydroperoxide remaining after decomposition is from 0.3 to 1.5 wt. % of the total weight of the decomposition products	wherein the quantity of cumene hydroperoxide remaining after decomposition is from 0.2 to 3 wt. % of the total weight of the reactor contents	The Hertzog specification describes the quantity of cumene hydroperoxide remaining after decomposition is from 0.2 to 3 wt. % of the total weight of the reactor contents. See page 7, lines
whereby the rate of decomposition of cumene hydroperoxide is reduced	whereby the rate of decomposition of cumene hydroperoxide is reduced	The addition of a diluent (i.e. acetone) to a reaction mixture inherently reduces the rate of the reaction. This reduced rate of reaction is suggested at page 7, lines 30-32 of the Hertzog specification.
and the reaction is more controllable	and the reaction is more controllable	The Hertzog specification describes a reaction which is more controllable. In particular, stability and enhanced safety are discussed. See page 4, lines 12 & 28.
and more selective.	and more selective.	The Hertzog specification describes a reaction which is more selective. See page 4, lines 17-18 and Fig. 2.

¹³ As pointed out at column 4, lines 34-37 of the Zakoshansky U.S. Patent No. 5,254,751, acetone and phenol are produced in an essentially 1 to 1 molar ratio in the reaction. If 10 % of the acetone produced is recycled to the decomposition reactor, the molar ratio of acetone to phenol in the reactor would be 1.1 to 1. If 100 % of the acetone produced is recycled to the decomposition reactor, the molar ratio of acetone to phenol in the reactor would be 2 to 1. Therefore, Hertzog's recitation encompasses that of Zakoshansky.

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ZAKOSHANSKY CLAIM 11	HERTZOG CLAIM 26	COMMENT
11. An improved method	26. An improved method	The Hertzog specification describes an improved method. Particular improvements include relatively high yields of AMS with low residual CHP (page 4, lines 14-18), as well as enhanced safety and reduced by-product formation (page 4, lines 28-30).
for the decomposition of dicumyl peroxide	for the decomposition of dicumyl peroxide	The Hertzog specification describes the decomposition of dicumyl peroxide (DCP). See page 9, lines 27-29.
to alpha methyl styrene,	to alpha methyl styrene,	The Hertzog specification describes the decomposition of dicumyl peroxide to produce alpha methyl styrene. See page 5, lines 3-7 and page 9, lines 27-29.
phenol and acetone,	phenol and acetone,	Phenol and acetone are known decomposition products of dicumyl peroxide. See column 1, lines 53-57 of the Zakoshansky U.S. Patent No. 5,254,751.
in the presence of an acidic catalyst	in the presence of an acidic catalyst	The Hertzog specification describes the use of an acid catalyst. See page 4, line 32; page 5, line 30; and page 6, lines 10-16.
wherein the improvement comprises: (a) carrying out a decomposition of cumene hydroperoxide	wherein the improvement comprises: (a) carrying out a decomposition of cumene hydroperoxide	The Hertzog specification describes the decomposition of cumene hydroperoxide. See page 4, lines 9-13, 26 and 31.
in the presence of an acidic catalyst	in the presence of an acidic catalyst	The Hertzog specification describes the use of an acid

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		catalyst. See page 4, line 32; page 5, line 30; and page 6, lines 10-16.
and excess acetone	and excess acetone	The Hertzog specification describes the decomposition of cumene hydroperoxide in the presence of excess acetone. See page 4, lines 14, 19 & 33.
to produce phenol, acetone,	to produce phenol, acetone,	The Hertzog specification describes the production of phenol and acetone. See page 1, lines 6-8.
and dicumyl peroxide;	and dicumyl peroxide;	The Hertzog specification describes the production of dicumyl peroxide. See page 5, lines 1-2.
(b) in a separate vessel, carrying out the decomposition of the dicumyl peroxide from step (a) at a temperature from about 80° to 110° C	(b) in a separate vessel, heating the dicumyl peroxide from step (a) to a temperature of greater than 90° C and carrying out the decomposition of dicumyl peroxide	The Hertzog specification describes the use of heater 8 to heat the reaction product of step (a) to the reaction temperature of pipe 9, which is 120° to 150°C. See page 9, lines 25-27. At least a portion of step (b) is carried out in heater 8. See page 9, lines 27-29. Therefore, part of step (b) takes place while the reactants are being heated from the maximum temperature of step (a), which is 90°C, to the minimum temperature of reactor 9, which is 120°C. Step (b) includes the decomposition of dicumyl peroxide to produce alpha methyl styrene. See page 5, lines 3-7.
in the presence of an acidic catalyst	in the presence of an acidic catalyst	The Hertzog specification describes the use of an acid catalyst to decompose DCP.

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		See page 6, lines 10-26 and page 10, lines 3-6.
whereby selectivity for alpha methyl styrene is enhanced;	whereby selectivity for alpha methyl styrene is enhanced;	The conversion of dicumyl peroxide to alpha methyl styrene would necessarily enhance selectivity for alpha methyl styrene. The Hertzog specification describes the decomposition of dicumyl peroxide to produce alpha methyl styrene. See page 5, lines 3-7 and page 9, lines 27-29. ¹⁴
(c) feeding at least a portion of the decomposition products of (b) to a separate vessel wherein the operating temperature is higher and the operating pressure is lower than in step (b) thereby allowing acetone to evaporate; and	(c) feeding at least a portion of the decomposition products of (b) to a separate vessel wherein acetone is allowed to evaporate; and	The Hertzog specification describes feeding at least a portion of the decomposition products of (b) to a separate vessel wherein acetone is allowed to evaporate. See page 4, lines 19-21; page 5, lines 8-11; and page 6, lines 1-4. Since the reaction is finished at this stage, the relative temperature of the acetone evaporation is irrelevant.
(d) recycling at least a portion of the acetone collected from step (c) to the cumene hydroperoxide decomposition of step (a).	(d) recycling at least a portion of the acetone collected from step (c) to the cumene hydroperoxide decomposition of step (a).	The Hertzog specification describes the recycle of acetone to step (a). See page 6, lines 3-4.

¹⁴ The Zakoshansky specification alleges that decomposition of dicumyl peroxide is enhanced at temperatures of 110°C or less, when a base is added to the reactants. However, Zakoshansky claim 11 does not recite the addition of a base to the reactants. Therefore, Zakoshansky claim 11 is not patentably distinct from Hertzog claim.

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ZAKOSHANSKY CLAIM 21	HERTZOG CLAIM 27	COMMENT
A composition comprising cumene hydroperoxide,	A composition comprising cumene hydroperoxide,	The Hertzog patent discloses a composition comprising cumene hydroperoxide. See page 4, lines 9-13, 26 and 31.
cumene,	cumene,	The Hertzog patent discloses a composition comprising cumene. See page 10, lines 17 & 22.
acidic catalyst for decomposition of cumene hydroperoxide,	acidic catalyst for decomposition of cumene hydroperoxide,	The Hertzog patent discloses a composition comprising an acidic catalyst. See page See page 6, lines 10-16 and page 10, line 24.
dicumyl peroxide,	dicumyl peroxide,	The Hertzog patent discloses a composition comprising dicumyl peroxide (DCP). See page 5, lines 1-2 and page 11, lines 3-5.
dimethylbenzyl alcohol,	dimethylbenzyl alcohol,	The Hertzog patent discloses a composition comprising dimethylbenzyl alcohol (i.e. dimethylphenyl carbinol or DMPC). See page 4, lines 24-30 and page 10, line 15.
phenol,	phenol,	The Hertzog patent discloses a composition comprising phenol. See page 4, lines 24-30 and page 10, line 22.
and acetone	and acetone	The Hertzog patent discloses a composition comprising acetone. See page 4, lines 24-30 and page 10 , lines 20-25.
wherein the acetone is in a molar ratio to phenol of from about 1.15:1 to 1.4:1.	wherein the acetone is in a molar ratio to phenol in excess of 1.	The Hertzog specification describes the addition of 10 to 100 percent acetone relative to the amount of acetone produced during the reaction to the decomposition reactor.

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		See page 4, lines 31-34. There is a difference in wording of the respective recitations in Zakoshansky claim 21 and the Hertzog claim 27. However, this difference is not patentably distinct, as explained in the footnote below. ¹⁵ Furthermore, Hertzog claim 28 recites a particular ratio of acetone to phenol falling within Zakoshansky's recitation.
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¹⁵ As pointed out at column 4, lines 34-37 of the Zakoshansky U.S. Patent No. 5,254,751, acetone and phenol are produced in an essentially 1 to 1 molar ratio in the reaction. If 10 % of the acetone produced is recycled to the decomposition reactor, the molar ratio of acetone to phenol in the reactor would be 1.1 to 1. If 100 % of the acetone produced is recycled to the decomposition reactor, the molar ratio of acetone to phenol in the reactor would be 2 to 1. Therefore, Hertzog's recitation encompasses that of Zakoshansky.

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ZAKOSHANSKY CLAIM 27	HERTZOG CLAIM 29	COMMENT
An improved method for preparing phenol	An improved method for preparing phenol	The Hertzog patent discloses an improved method for preparing <i>phenol</i> , acetone and AMS from the decomposition of cumene oxidation product. It does so with improved stability, safety and reduced by-product formation. See p. 4, lines 9-13, 27-29; p. 5, line 38.
and acetone	and acetone	The Hertzog patent discloses an improved method for preparing phenol, <i>acetone</i> and AMS from the decomposition of cumene oxidation product. It does so with improved stability, safety and reduced by-product formation. See p. 4, lines 9-13, 27-29; p. 5, line 38.
from the decomposition of cumene hydroperoxide	from the decomposition of cumene hydroperoxide	The Hertzog patent describes the production of phenol, acetone and AMS from the decomposition of cumene oxidation product, which is CHP and DMPC. See p. 4, line 27, 28.
with an acidic catalyst	with an acidic catalyst	The Hertzog patent discloses the decomposition reaction of cumene oxidation products using an acidic catalyst. See. p. 4, line 32; p. 5, line 30; p. 6, line 10-16.
wherein the improvement comprises (a) decomposing cumene hydroperoxide	wherein the improvement comprises (a) decomposing cumene hydroperoxide	The Hertzog patent describes the decomposition of CHP. See p. 4, lines 9-13, 26 & 31.
in the presence of cumene	in the presence of cumene	The Hertzog specification describes the decomposition

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		of cumene hydroperoxide in the presence of cumene. See page 10, lines 17 & 22.
in an amount of about 10 to 18 weight percent of the reactor composition		The Hertzog specification describes the decomposition of cumene hydroperoxide in the presence of cumene. The Hertzog does not specify that the amount of cumene is within the range of about 10 to 18 weight percent of the reactor composition. However, this particular quantity of cumene is an immaterial limitation. See the explanation in the footnote below. ¹⁶ Furthermore, a particular quantity of cumene falling within this range is recited in Hertzog claim 30.
and at a specific acidic catalyst concentration	and at a specific acidic catalyst concentration	The Hertzog specification discloses that the acidic concentration should be between 30 and 500 ppm of the reaction mass. See p. 6, line 15-16.
and temperature	and temperature	The Hertzog specification

¹⁶ As a practical matter, it would be difficult to avoid the presence of from about 10 to 18 weight percent of cumene in the decomposition reactor. Cumene hydroperoxide is typically produced by oxidizing cumene. Residual, unreacted cumene, in an amount of from 10 to 18 weight percent, is typically included in the cumene hydroperoxide. For example, at column 6, line 67 to column 7, line 1 of the Sifniades U.S. Patent No. 4,358,618, there is described a technical cumene hydroperoxide (CHP) containing 83 wt% CHP, 3.2 wt% "carbinol" (a.k.a. dimethylphenyl carbinol, DMPC, dimethylbenzyl alcohol, and DMBA) and 0.4 wt% acetophenone with the balance (i.e. 13.4 wt%) being cumene. Similarly, at column 7, lines 65-67 of the Zakoshansky U.S. Patent No. 5,254,751, there is described a technical cumene hydroperoxide (CHP) containing 83.80 wt% CHP, 3.64 wt% DMBA, 0.40 wt% acetophenone and 12.16 wt% cumene. A similar cumene oxidation product is described at page 10, lines 14-17 of the Hertzog specification and has 81.6 wt% CHP, 5.00 wt% DMPC and 0.40 wt% acetophenone, with the balance (i.e. 13 wt.%) being mostly cumene.

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		discloses that step (a) of the process should be completed between 50 and 90°C. See p. 4, line 35-36; p. 8, line 36; p. 10, line 32.
whereby a composition comprising phenol,	whereby a composition comprising phenol,	The Hertzog patent describes a composition comprising phenol from the decomposition of CHP. See p. 4, lines 9-11, 25-27, p. 5, line 38.
acetone	acetone	The Hertzog patent discloses a composition comprising acetone from the decomposition of CHP. See page 4, lines 9-11, 25-27; p. 5, line 38.
and dicumyl peroxide is formed,	and dicumyl peroxide is formed,	The Hertzog patent discloses a composition comprising DCP from the decomposition of CHP. See p. 5, lines 1-2.
(b) transferring dicumyl peroxide to a plug flow reactor	(b) transferring dicumyl peroxide to a plug flow reactor	The Hertzog patent describes a process that produces DCP and reacts it under plug-flow conditions. See p. 5, lines 2-5.
wherein decomposition of dicumyl peroxide to phenol, acetone and alphamethylstyrene occurs	wherein decomposition of dicumyl peroxide to phenol, acetone and alphamethylstyrene occurs	The Hertzog patent describes the effluent from step (a) of the reaction process, which contains DCP, as it decomposes under plug flow conditions to form phenol, acetone and AMS. See p. 5, lines 35-38; p. 9, lines 28-29, 36-37.
in a weaker acidic catalyst medium and a higher temperature than the catalyst concentration and temperature in step (a)	at a higher temperature than the temperature in step (a)	The Hertzog patent describes part (b) of the reaction at a higher temperature than in step (a). Heater 8 is used to heat the reaction product of step (a) to the reaction temperature of pipe 9, which

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		is 120° to 150°C. See p. 9, lines 25-27. Step (b) is carried out in heater 8 and pipe 9. See p. 9, line 27. This temperature is higher than that used in part (a), which is 50° to 90°C. See p. 4, lines 35-36. The recitation that step (b) takes place in a weaker catalyst medium than step (a) is not material. ¹⁷
whereby the dicumyl peroxide decomposition is better controlled.	whereby the dicumyl peroxide decomposition is better controlled.	The Hertzog patent describes a reaction that is more controllable. In particular, stability, enhanced safety and reduced by-product formation are discussed. See p. 4, lines 12 & 28-29.

¹⁷ The number of moles of catalyst remains constant throughout the reaction. However, the total number of moles of other species increases as the decomposition reactions progress. For example, each mole of CHP produces two moles of product (i.e. one mole of acetone and one mole of phenol). Therefore, on a molar basis, the concentration of the catalyst decreases as the reaction proceeds.

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ZAKOSHANSKY CLAIM 28	HERTZOG CLAIM 31	COMMENT
28. An improved method for preparing phenol	31. An improved method for preparing phenol	The Hertzog patent discloses an improved method for preparing <i>phenol</i> , acetone and AMS from the decomposition of cumene oxidation product. It does so with improved stability, safety and reduced by-product formation. See p. 4, lines 9-13, 27-29; p. 5, line 38.
and acetone	and acetone	The Hertzog patent discloses an improved method for preparing phenol, <i>acetone</i> and AMS from the decomposition of cumene oxidation product. It does so with improved stability, safety and reduced by-product formation. See p. 4, lines 9-13, 27-29; p. 5, line 38.
from the decomposition of cumene hydroperoxide	from the decomposition of cumene hydroperoxide	The Hertzog patent describes the production of phenol, acetone and AMS from the decomposition of cumene oxidation product, which is CHP and DMPC. See p. 4, line 27, 28.
with an acidic catalyst	with an acidic catalyst	The Hertzog patent discloses the decomposition reaction of cumene oxidation products using an acidic catalyst. See. p. 4, line 32; p. 5, line 30; p. 6, line 10-16.
wherein the improvement comprises: (a) decomposing cumene hydroperoxide	wherein the improvement comprises: (a) decomposing cumene hydroperoxide	The Hertzog patent describes the decomposition of CHP. See p. 4, lines 9-13, 26 & 31.
at a specific acidic catalyst	at a specific acidic catalyst	The Hertzog specification

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concentration	concentration	discloses that the acidic concentration should be between 30 and 500 ppm of the reaction mass. See p. 6, line 15-16.
and temperature	and temperature	The Hertzog specification discloses that step (a) of the process should be completed between 50 and 90°C. See p. 4, line 35-36; p. 8, line 36; p. 10, line 32.
whereby a composition comprising phenol, acetone and dicumyl peroxide is formed,	whereby a composition comprising phenol, acetone and dicumyl peroxide is formed,	The Hertzog patent discloses a composition comprising phenol, acetone and dicumyl peroxide. See p. 5, lines 1-2, 7-8, 38.
(b) transferring dicumyl peroxide to a plug flow reactor	(b) transferring dicumyl peroxide to a plug flow reactor	The Hertzog patent describes a process that produces DCP and reacts it under plug-flow conditions. See p. 5, lines 2-5.
wherein decomposition of dicumyl peroxide to phenol, acetone and alphas-methylstyrene occurs	wherein decomposition of dicumyl peroxide to phenol, acetone and alphas-methylstyrene occurs	The Hertzog patent describes the effluent from step (a) of the reaction process, which contains DCP, as it decomposes under plug flow conditions to form phenol, acetone and AMS. See p. 5, lines 35-38; p. 9, lines 28-29, 36-37.
in a weaker acidic catalyst medium		The recitation that step (b) takes place in a weaker catalyst medium than step (a) is not material. ¹⁸
and a higher temperature	at higher temperature	The Hertzog patent describes part (b) of the reaction at a

¹⁸ The number of moles of catalyst remains constant throughout the reaction. However, the total number of moles of other species increases as the decomposition reactions progress. For example, each mole of CHP produces two moles of product (i.e. one mole of acetone and one mole of phenol). Therefore, on a molar basis, the concentration of the catalyst decreases as the reaction proceeds.

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		higher temperature than in step (a). Heater 8 is used to heat the reaction product of step (a) to the reaction temperature of pipe 9, which is 120° to 150°C. See p. 9, lines 25-27. Step (b) is carried out in heater 8 and pipe 9. See p. 9, line 27. This temperature is higher than that used in part (a), which is 50° to 90°C. See p. 4, lines 35-36.
than the catalyst concentration		The recitation regarding the catalyst concentration is not material. ¹⁹
and temperature in step (a)	than the temperature in step (a)	The Hertzog patent describes part (b) of the reaction at a higher temperature than in step (a). Heater 8 is used to heat the reaction product of step (a) to the reaction temperature of pipe 9, which is 120° to 150°C. See p. 9, lines 25-27. Step (b) is carried out in heater 8 and pipe 9. See p. 9, line 27. This temperature is higher than that used in part (a), which is 50° to 90°C. See p. 4, lines 35-36.
whereby the dicumyl peroxide decomposition is better controlled,	whereby the dicumyl peroxide decomposition is better controlled,	The Hertzog patent describes a reaction that is more controllable. In particular, stability, enhanced safety and reduced by-product formation are discussed. See p. 4, lines

¹⁹ The number of moles of catalyst remains constant throughout the reaction. However, the total number of moles of other species increases as the decomposition reactions progress. For example, each mole of CHP produces two moles of product (i.e. one mole of acetone and one mole of phenol). Therefore, on a molar basis, the concentration of the catalyst decreases as the reaction proceeds.

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		12 & 28-29.
wherein in step (a) the temperature is from about 70°-90° C.	wherein in step (a) the temperature is from about 50°-90° C.	The Hertzog patent describes a process that uses a temperature from about 50° to 90°C in step (a). See p. 4, line 36; p. 5, line 15; p. 7, line 13-14.
and the catalyst concentration is from about 50-750 ppm of the decomposition mass	and the catalyst concentration is from about 30-500 ppm of the reaction mass	The Hertzog patent describes a process that uses a catalyst concentration from about 30 to 500 ppm of reaction mass. See p. 6, lines 15-16.
and in step (b) the temperature is from about 80° to 110° C.	and in step (b) the temperature is from about 90° to 150° C.	The Hertzog patent describes the temperature in step (b) to be about 120°C to 150°C. See p. 5, lines 4 & 36; p. 9, line 25. Furthermore, at least a portion of step (b) takes place while the reactants are in heater 8. See p. 9, lines 25-29. Therefore, part of step (b) takes place while the reactants are being heated from the maximum temperature of step (a), which is 90°C, to the minimum temperature of reactor 9, which is 120°C.
and the catalyst in step (a) has been lowered about 10 to 99 mole %.		The recitation implying that the catalyst concentration is lowered by a certain amount is not material. ²⁰

²⁰ The number of moles of catalyst remains constant throughout the reaction. However, the total number of moles of other species increases as the decomposition reactions progress. For example, each mole of CHP produces two moles of product (i.e. one mole of acetone and one mole of phenol). Therefore, on a molar basis, the concentration of the catalyst decreases as the reaction proceeds.

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ZAKOSHANSKY CLAIM 30	HERTZOG CLAIM 32	COMMENT
30. An improved method for maintaining control of an acid catalyzed cumene hydroperoxide decomposition	32. An improved method for maintaining control of an acid catalyzed cumene hydroperoxide decomposition	The Hertzog patent describes an improved method of an acid catalyzed cumene hydroperoxide decomposition. Particular improvements include relatively high yields of AMS w/ low residual CHP (p. 4, lines 14-18), as well as enhanced safety and reduced by-product formation. See p. 4, lines 28-30. The reaction uses an acid catalyst. See p. 4, line 32.
in a multiplicity of sequential reactors	in a multiplicity of sequential reactors	The Hertzog patent describes the use of a stirred or back-mixed reactor in step (a) (See p. 4, line 32) followed by a plug flow reactor (PFR) in step (b). See p. 5, line 5. The Hertzog patent describes the use of an optional second reactor after step (a) to further reduce the CHP concentration. See p. 5, lines 12-18; p. 6 lines 5-9.
wherein the improvement comprises passing a portion of the outlet stream of the last sequential reactor	wherein the improvement comprises passing a portion of the outlet stream of a back mixed reactor	The Hertzog patent describes a process that passes a portion (100%) of the stream from part (a) into a PFR. See p. 5, lines 3-5, 35-37.
into a reactor of plug flow design	into a reactor of plug flow design	The Hertzog patent describes a process that uses a plug flow reactor in part (b). See p. 5, lines 5 & 37.
and a smaller size compared to the cumene hydroperoxide decomposition reactors	and a smaller size compared to the cumene hydroperoxide decomposition reactors	The Hertzog patent describes an example that uses a reactor in step (a) with a residence time of 16 min and a volume

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		of 30 ml (See p. 10, line 20, 32) and a reactor in step (b) with a residence time of 1.6 min. See p. 10, line 35. The volume in reactor (b) can be estimated to be around 3 ml. See footnote ²¹
wherein the delta T °C. of the inlet temperature and the outlet temperature of said plug flow reactor is from about 4 ° to 16 °C.	wherein the inlet temperature is lower than the outlet temperature of said plug flow reactor	The Hertzog patent describes a process where the temperature at the exit of the plug flow reactor (PFR) is higher than the inlet temperature due to the exothermic decomposition of DCP and CHP and dehydration of DMPC to AMS. See p. 9, lines 30-32.
whereby the smaller size reactor decomposes essentially all of the cumene hydroperoxide remaining in said portion of the outlet stream	whereby the smaller size reactor decomposes essentially all of the cumene hydroperoxide remaining in said portion of the outlet stream	The reactor in step (b) decomposes essentially all of the CHP from step (a). See p. 9, line 29.
and provides an analytical indication of the completeness of the cumene hydroperoxide decomposition reaction	and provides an analytical indication of the completeness of the cumene hydroperoxide decomposition reaction	The reactor in step (b) provides an analytical indication of the completeness of the CHP decomposition reaction (see p. 9, lines 18-19) by monitoring the DCP concentration at 3 points along pipe 9 (See p. 9, lines 38-39; p. 10, lines 1-2) and mol % yield of AMS. See p. 11, lines 7-9.
and the reactors are thereby controlled.	and the reactors are thereby controlled.	The Hertzog patent describes a process that monitors the CHP

²¹ If the system is at steady-state with no overflow from reactor (a), the flow rate into reactor (b) will be 1.85 g/min (1.62+0.23 g/min into reactor (a)). The residence time in reactor (b) is 1.6 min so the grams into reactor (b) = 2.96 g (1.6 min * (1.85 g/min)). If the density of the liquid is estimated at 1 g/cm³, the volume is 2.96 cm³ or 2.96 ml.

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		concentration and AMS yield throughout the system and thereby controls the reactors. See p. 8, lines 9-11; p. 11, lines 5-9.
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ZAKOSHANSKY CLAIM 33	HERTZOG CLAIM 33	COMMENT
33. An improved method for enhancing the decomposition of cumene hydroperoxide	33. An improved method for enhancing the decomposition of cumene hydroperoxide	The Hertzog patent describes an improved method for the decomposition of cumene hydroperoxide. See p. 4, lines 9-13, 26 & 31. Particular improvements include relatively high yields of AMS w/ low residual CHP (p. 4, lines 14-18), as well as enhanced safety and reduced by-product formation (p. 4, lines 28-30).
and producing cumene hydroperoxide decomposition products therefrom	and producing cumene hydroperoxide decomposition products therefrom	The Hertzog patent describes the production of cumene hydroperoxide decomposition products, specifically phenol, acetone and AMS. See p. 4, lines 11, 26-28.
wherein the improvement comprises recycling the cumene hydroperoxide decomposition products	wherein the improvement comprises recycling the cumene hydroperoxide decomposition products	The Hertzog specification describes the recycling of acetone (a CHP decomposition product) to obtain good AMS yields and low by-product formation. See p. 5, lines 9-11; 12, lines 1-3. Furthermore, reaction products are back-mixed into reactor 1. See p. 8, line 33 to page 9, line 15.
to a cumene hydroperoxide feedstream	to a cumene hydroperoxide feedstream	The Hertzog patent describes recycling acetone to the CHP feed stream. See p. 5, lines 9-11.
in the quantity of from about 10-25 times the weight of the cumene hydroperoxide feedstream		The particular quantity of product recycle is immaterial. The rate of recycle is a matter of obvious engineering design choice. Furthermore, both

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		Zakoshansky and Hertzog use essentially the same feed (e.g., technical CHP) to step (a) and maintain essentially the same low levels of CHP in the overall reaction mass of step (a). Therefore, the rates of decomposition products must be essentially the same.
and wherein additional acetone is added to the cumene hydroperoxide decomposition products	and wherein additional acetone is added to the cumene hydroperoxide decomposition products	The Hertzog patent describes adding acetone to the CHP decomposition products in addition to the acetone produced. See p. 4, lines 14-16.
as to maintain a ratio of about 1.1 to 1 to 1.5 to 1 acetone to phenol in the cumene hydroperoxide decomposition reaction	so as to add 10 to 100 percent acetone relative to the amount of acetone produced during the cumene hydroperoxide decomposition reaction	The Hertzog specification describes the addition of 10 to 100 percent acetone relative to the amount of acetone produced during the reaction to the decomposition reactor. See page 4, lines 31-34. There is a difference in wording of the respective recitations in Zakoshansky claim 33 and the Hertzog claim 33. However, this difference is not patentably distinct, as explained in the footnote below. ²²
whereby selectivity is higher and safety of the process is improved.	whereby selectivity is higher and safety of the process is improved.	The Hertzog patent describes a reaction which is more selective. See p. 4, lines 17-

²² As pointed out at column 4, lines 34-37 of the Zakoshansky U.S. Patent No. 5,254,751, acetone and phenol are produced in an essentially 1 to 1 molar ratio in the reaction. If 10 % of the acetone produced is recycled to the decomposition reactor, the molar ratio of acetone to phenol in the reactor would be 1.1 to 1. If 100 % of the acetone produced is recycled to the decomposition reactor, the molar ratio of acetone to phenol in the reactor would be 2 to 1. Therefore, Hertzog's recitation encompasses that of Zakoshansky.

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ZAKOSHANSKY CLAIM 34	HERTZOG CLAIM 34	COMMENT
34. The method in accordance with claim 33 wherein additional water is added to the cumene hydroperoxide decomposition products	34. The method in accordance with claim 33 wherein additional water is added to the cumene hydroperoxide decomposition products	The Hertzog patent describes the addition of water to the CHP decomposition products. See p. 4, lines 34-35; p. 5, lines 30-31; p. 12, examples 1-12.
to a level not greater than 3 wt. % in the cumene hydroperoxide decomposition mass.	to a level not greater than 4 wt. % in the cumene hydroperoxide decomposition mass.	The Hertzog patent describes the reaction with up to 4 wt % water relative to the reaction mass. See p. 4, lines 34-35; p. 7, lines 9-10.

ZAKOSHANSKY CLAIM 35	HERTZOG CLAIM 35	COMMENT
35. The method in accordance with claim 34 wherein the level is not greater than 2 wt. % .	35. The method in accordance with claim 34 wherein the level is between 0.03 and 1.34 wt. % .	The Hertzog patent describes adding between 0.03 and 1.34 wt % of water to the reaction mass in all of the examples. See p. 12, examples 1-12.

ZAKOSHANSKY CLAIM 36	HERTZOG CLAIM 35	COMMENT
36. The method in accordance with claim 34 wherein the level is not greater than 1.5 wt. % .	35. The method in accordance with claim 34 wherein the level is between 0.03 and 1.34 wt. % .	The Hertzog patent describes adding between 0.03 and 1.34 wt % of water to the reaction mass in all of the examples. See p. 12, examples 1-12.

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ZAKOSHANSKY CLAIM 37	HERTZOG CLAIM 36	COMMENT
37. An improved method for enhancing the decomposition of cumene hydroperoxide to phenol and acetone	36. An improved method for enhancing the decomposition of cumene hydroperoxide to phenol and acetone	The Hertzog patent describes an improved method for the decomposition of cumene hydroperoxide to phenol and acetone. See p. 4, lines 9-13, 26-27. Particular improvements include relatively high yields of AMS w/ low residual CHP (p. 4, lines 14-18), as well as enhanced safety and reduced by-product formation (p. 4, lines 28-30).
wherein the improvement comprises decomposing cumene hydroperoxide	wherein the improvement comprises decomposing cumene hydroperoxide	The Hertzog patent describes an improved method for the decomposition of cumene hydroperoxide. See p. 4, lines 9-13, 26-27.
in a non-isothermal manner		The Hertzog specification describes a non-isothermal reaction. However, it is immaterial whether the reaction is run in a isothermal or non-isothermal manner. See explanation in footnote below. ²³ Furthermore, a non-isothermal reaction is recited in Hertzog claim 37.
in a decomposition reactor	in a decomposition reactor	The Hertzog specification describes the decomposition

²³ Whether or not the reaction is run in a non-isothermal manner is immaterial, because page 7, lines 13-25 of the Hertzog specification points out that "an almost infinite variety of reaction conditions" can be used. Furthermore, at column 4, lines 28-30 of the Zakoshansky U.S. Patent No. 5,254,751, isothermal reaction conditions are equated to constant boiling or refluxing type systems, which are not disclosed in the Hertzog specification, and which would not be practical for use in a system wherein acetone is to be recycled.

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		of cumene hydroperoxide in a decomposition reactor. See page 4, line 32 and page 5, lines 31-32.
in the presence of cumene	in the presence of cumene	The Hertzog specification describes the decomposition of cumene hydroperoxide in the presence of cumene. See page 10, lines 17 & 22.
in an amount of about 10 to 18 weight percent of the reactor composition		The Hertzog specification describes the decomposition of cumene hydroperoxide in the presence of cumene, wherein the amount of cumene is within the range of about 10 to 18 weight percent of the reactor composition. However, this particular quantity of cumene is an immaterial limitation. See the explanation in the footnote below. ²⁴ Furthermore, a particular quantity of cumene falling within this range is recited in Hertzog claim 38.
and introducing additional water into the cumene	and introducing additional water into the cumene	The Hertzog patent describes the addition of water to the

²⁴ As a practical matter, it would be difficult to avoid the presence of from about 10 to 18 weight percent of cumene in the decomposition reactor. Cumene hydroperoxide is typically produced by oxidizing cumene. Residual, unreacted cumene, in an amount of from 10 to 18 weight percent, is typically included in the cumene hydroperoxide. For example, at column 6, line 67 to column 7, line 1 of the Sifniades U.S. Patent No. 4,358,618, there is described a technical cumene hydroperoxide (CHP) containing 83 wt% CHP, 3.2 wt% "carbinol" (a.k.a. dimethylphenyl carbinol, DMPC, dimethylbenzyl alcohol, and DMBA) and 0.4 wt% acetophenone with the balance (i.e. 13.4 wt%) being cumene. Similarly, at column 7, lines 65-67 of the Zakoshansky U.S. Patent No. 5,254,751, there is described a technical cumene hydroperoxide (CHP) containing 83.80 wt% CHP, 3.64 wt% DMBA, 0.40 wt% acetophenone and 12.16 wt% cumene. A similar cumene oxidation product is described at page 10, lines 14-17 of the Hertzog specification and has 81.6 wt% CHP, 5.00 wt% DMPC and 0.40 wt% acetophenone, with the balance (i.e. 13 wt%) being mostly cumene.

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hydroperoxide decomposition reactor.	hydroperoxide decomposition reactor.	CHP decomposition products. See p. 4, lines 34-35; p. 5, lines 30-31; p. 12, Examples 1-12.
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ZAKOSHANSKY CLAIM 38	HERTZOG CLAIM 39	COMMENT
38. A cumene hydroperoxide decomposition mass produced from the reaction of cumene hydroperoxide	39. A cumene hydroperoxide decomposition mass produced from the reaction of cumene hydroperoxide	The Hertzog patent describes the production of CHP decomposition mass from the reaction of CHP. See p. 4, lines 9-11, 25-28.
with an acid catalyst,	with an acid catalyst,	The Hertzog specification describes the use of an acid catalyst. See page 4, line 32; page 5, line 30 and page 6, lines 10-16.
wherein the acid catalyst is sulfuric acid,	wherein the acid catalyst is sulfuric acid,	The Hertzog specification describes the use of sulfuric acid as the acid catalyst. See page 6, lines 10-16 and page 10, line 24.
in a continuous	in a continuous	The Hertzog specification describes a continuous method. In particular, it is pointed out that the reaction can reach a steady state. See page 10, line 36 and page 11, line 3. Furthermore, at page 1, lines 6-11, it is pointed out that commercial scale methods are carried out in a continuous manner.
non-isothermal manner	manner	The Hertzog specification describes a non-isothermal reaction. However, it is immaterial whether the reaction is run in a isothermal or non-isothermal manner. See explanation in footnote

²⁵ Whether or not the reaction is run in a non-isothermal manner is immaterial, because page 7, lines 13-25 of the Hertzog specification points out that "an almost infinite variety of reaction conditions" can be used. Furthermore, at column 4, lines 28-30 of the Zakoshansky U.S. Patent No. 5,254,751,

...(footnote continued)

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		below. ²⁵ Furthermore, a non-isothermal reaction is recited in Hertzog claim 40.
having an acetone to phenol mole ratio of about 1.1 to 1 to 1.5 to 1	having 10 to 100 percent excess acetone relative to the amount of acetone produced during the reaction	The Hertzog specification describes the addition of 10 to 100 percent acetone relative to the amount of acetone produced during the reaction to the decomposition reactor. See page 4, lines 31-34. There is a difference in wording of the respective recitations in Zakoshansky claim 38 and the Hertzog claim 39. However, this difference is not patentably distinct, as explained in the footnote below. ²⁶ Furthermore, Hertzog claim 41 recites a particular ratio of acetone to phenol falling within Zakoshansky's recitation.
and cumene	and cumene.	The Hertzog patent discloses a composition comprising cumene. See page 10, lines 17 & 22.
in an amount of about 10 to 18 weight percent of the decomposition mass.		The Hertzog specification describes the decomposition of cumene hydroperoxide in

isothermal reaction conditions are equated to constant boiling or refluxing type systems, which are not disclosed in the Hertzog specification, and which would not be practical for use in a system wherein acetone is to be recycled.

²⁶ As pointed out at column 4, lines 34-37 of the Zakoshansky U.S. Patent No. 5,254,751, acetone and phenol are produced in an essentially 1 to 1 molar ratio in the reaction. If 10 % of the acetone produced is recycled to the decomposition reactor, the molar ratio of acetone to phenol in the reactor would be 1.1 to 1. If 100 % of the acetone produced is recycled to the decomposition reactor, the molar ratio of acetone to phenol in the reactor would be 2 to 1. Therefore, Hertzog's recitation encompasses that of Zakoshansky.

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		<p>the presence of cumene, wherein the amount of cumene is within the range of about 10 to 18 weight percent of the reactor composition. However, this particular quantity of cumene is an immaterial limitation. See the explanation in the footnote below.²⁷ Furthermore, a particular quantity of cumene falling within this range is recited in Hertzog claim 42.</p>
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²⁷ As a practical matter, it would be difficult to avoid the presence of from about 10 to 18 weight percent of cumene in the decomposition reactor. Cumene hydroperoxide is typically produced by oxidizing cumene. Residual, unreacted cumene, in an amount of from 10 to 18 weight percent, is typically included in the cumene hydroperoxide. For example, at column 6, line 67 to column 7, line 1 of the Sifniades U.S. Patent No. 4,358,618, there is described a technical cumene hydroperoxide (CHP) containing 83 wt% CHP, 3.2 wt% "carbinol" (a.k.a. dimethyl phenyl carbinol, DMPC, dimethyl benzyl alcohol, and DMBA) and 0.4 wt% acetophenone with the balance (i.e. 13.4 wt%) being cumene. Similarly, at column 7, lines 65-67 of the Zakoshansky U.S. Patent No. 5,254,751, there is described a technical cumene hydroperoxide (CHP) containing 83.80 wt% CHP, 3.64 wt% DMBA, 0.40 wt% acetophenone and 12.16 wt% cumene. A similar cumene oxidation product is described at page 10, lines 14-17 of the Hertzog specification and has 81.6 wt% CHP, 5.00 wt% DMPC and 0.40 wt% acetophenone, with the balance (i.e. 13 wt%) being mostly cumene.

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ZAKOSHANSKY CLAIM 39	HERTZOG CLAIM 43	COMMENT
39. A method for the efficient generation of recycle acetone	43. A method for the efficient generation of recycle acetone	The Hertzog patent describes the generation of recycle acetone that saves energy. See p. 6, lines 17-22.
in a process which prepares phenol and acetone from cumene	in a process which prepares phenol and acetone from cumene	The Hertzog patent describes the preparation of phenol and acetone from cumene. See p. 4, lines 9-11, 25-27.
comprising: (a) decomposing dicumyl peroxide to phenol, acetone, and alpha methyl styrene	comprising: (a) decomposing dicumyl peroxide to phenol, acetone, and alpha methyl styrene	The Hertzog patent describes the effluent from step (a) of the reaction process, which contains DCP, as it decomposes to form phenol, acetone and AMS. See p. 5, lines 35-38; p. 9, lines 28-29, 36-37.
(b) feeding at least a portion of decomposition products of (a) to a separate vessel	(b) feeding at least a portion of decomposition products of (a) to a separate vessel	The Hertzog patent describes feeding a portion of the decomposition products to a flash evaporator. See p. 5, lines 8-11.
wherein operating temperature is higher	wherein operating temperature is higher	The Hertzog patent describes an operating temperature of about 120° to 150°C for part (b), which is higher than the temperature used in part (a) of 50° to 90°C (see p. 4, line 36). See p. 5, lines 4, 36. The reaction mass is at this operating temperature when flash evaporation occurs.
operating pressure is lower than in step (a),	operating pressure is lower than in step (a),	The Hertzog describes evaporating acetone at a lower pressure that used in step (a). In particular, in Example 1 Hertzog states that a feed including acetone is pumped into a closed reactor. See p. 10, lines 20-25. This closed

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		reactor is maintained at a temperature of 80°C. See p. 10, lines 31-32. The boiling point of acetone is 56.2°C. Therefore, the temperature in step (a) is greater than atmospheric. Since flash evaporation takes place at atmospheric pressure, the pressure during evaporation is less than the pressure used in step (a).
thereby allowing acetone to evaporate,	thereby allowing acetone to evaporate,	The Hertzog patent describes a flash evaporation to recover the acetone. See p. 5, lines 9-10.
(c) sending at least a portion of acetone collected from step (b) to the cumene hydroperoxide decomposition reaction.	(c) sending at least a portion of acetone collected from step (b) to the cumene hydroperoxide decomposition reaction.	The Hertzog patent describes recycling an amount of acetone back to the feed. See p. 4, lines 31-34; 5, lines 9-11.

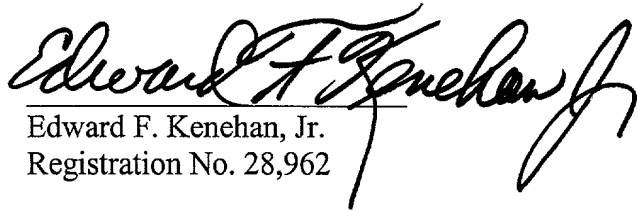
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CONCLUSION

If the subject matter of the of Zakoshansky's claims is allowable to Zakoshansky, then the subject matter of Hertzog's claims must also be allowable to Hertzog. If the subject matter of Hertzog's claims is determined to be unpatentable over prior art, then that prior art must be applied against Zakoshansky in the merged Reissue Application Serial No. 08/545,092 and Reexamination Proceeding Control No. 90/004,314.

Unless Zakoshansky's claims are rejected, further prosecution of Zakoshansky's reissue/reexamination should be suspended until Hertzog's application issues as a patent and Zakoshansky's claims are rejected over Hertzog's patent.

Respectfully submitted,


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